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New Opportunities

Great efforts on a national basis are made in the United States by the foundry industry to induce undergraduates—those reading engineering and science—to enter the cast-metals industry as a career. They are approached before graduation and every help is given to the young men to spend their vacations in foundries and to take post-graduate courses, designed to fit them for positions in this industry. In similar spheres, the Continental system of high-school instruction, generally speaking, automatically supplies well-trained technologists, ultimately fully capable of filling the highest executive positions in the foundry industry. In this country, the position is also fairly satisfactory, with the one exception of the provision of the best type of scientific brains.

This gap can be filled in the future if, and only if, the creation by the Faculty of Metallurgy, University of Birmingham, of a post-graduate course in the foundry sciences is fully taken advantage of. We recently published details of the proposed syllabus*, which we deem to be of a high standard and of the type likely to appeal to far-sighted foundry managements. The training to be given is widely based and ranges from the control of hydrogen, oxygen, carbon, sulphur and phosphorus in cast metals to special foundry techniques in nuclear engineering. Graduates so trained should be of great use in getting the best results from the millions of pounds invested by the industry in new plant and processes during the post-war years. Moreover, these young men ought to be in a good position to grasp the requirements of those customers who are ever demanding enhanced properties from castings. Nowadays, quite out-of-the-ordinary requirements are sought from castings, as, for instance, a modicum of malleability in cast iron, superior erosion-resistance, greater strength at elevated temperatures, and possibly, others as yet unformulated from the atomic-energy engineers. In the foundries of the future, someone must be available to talk to these engineers in their own language—it will be insufficient to ask for a blue-print and confidently promise a satisfactory casting to an untried specification. Again, the internal foundry management may wish to know more about heat flow and losses, the calculations for which are not easy, and even the assimilation and application of existing knowledge of such matters presents difficulties.

To implement the wishes of the University, the foundry industry must find endowments—a matter of £400 per annum—for each of about eight suitable graduates. Serious consideration is already being given to providing two or three scholarships; thus, it further needs but half-a-dozen foundry concerns to make themselves responsible for such sums for a few years to give the course a satisfactory launching. Unquestionably, this is not a heavy burden to place on the balance of the industry and potential benefits far outweigh the cost. It is germane to remind the UK industry that with the opening to them of the 350-million population of the European market, their Continental competitors are equipping themselves with the best scientific brains they can employ. The offer made by Birmingham University must be taken up enthusiastically, for if it becomes what is termed in modern jargon, "a flop," it might be a decade or more before a second chance were offered. In the meantime, our industry would fall further behind in competing for the cream of the country's graduates.

* JOURNAL, January 9, page 49.

Investment Casters' Conference

The 1958 conference of the European Investment Casters' Association is to be held in Paris from May 18 to 21, with headquarters at the Hotel de la Campagnie, 89, Rue Taitbout. General particulars of the programme are as follow:—

May 18 (*Sunday*): 6 to 8 p.m. Cocktail Party.

Monday: 9.30 a.m. Two technical sessions both in the morning and afternoon (with breaks for coffee at 10.45 a.m., luncheon 12 noon, and tea 4.15 p.m.). Later there will be an international social evening at 33, Rue de Faubourg St. Honore.

Tuesday: Technical sessions from 9.30 a.m. to 6 p.m. with the usual breaks for refreshments. The official banquet (lounge suits) will be held in the evening, commencing at 8 p.m.

Wednesday: Technical sessions in the morning, and in the afternoon a works visit to the Renault establishments.

Ladies' Programme

On Monday a coach trip to the Ile-de-France has been arranged, and on Tuesday, the ladies have a choice of either a sightseeing coach trip around Paris, or a boat trip on the Seine. There will also be a "dress show" commencing at 5 p.m. at one of the Paris salons. On Wednesday afternoon the visit to the Renault works will be open to ladies.

This year, to stimulate discussion, each member is invited to bring to the technical sessions at least one casting of which, because of some characteristic or other, he has reason to be proud. It should have presented some specific problem either in its manufacture or practical application, and it should also be of general interest to the precision-casting industry. It is to be hoped that one result of this idea will be to enable the Association to carry out the idea they are considering of giving an award for the best casting of the year, and continuing this practice in future.

Applications to attend the conference should be addressed to Mr. P. Chevé, c/o Compagnie des Ateliers et Forges de la Loire, 12, rue de la Rochefoucald, Paris, 9. The conference fee is 12,000 francs.

International Enamellers' Council

To investigate the possibilities of increasing collaboration with enamellers throughout the world was the purpose of the Institute of Vitreous Enamellers in convening a meeting held in Brussels at the end of last year. Representatives of organized institutes in Europe attended and observers from countries where no recognized institutes exist were also invited.

The Institute proposed that some organization should be established for furthering the interchange of technical information, and which could help in stimulating the internal organization of the industry in those countries where no technical societies, or institute responsible for organizing the technical side of the institute, existed. The Institute also proposed that the principal function of such an organization would be to ensure that information relating to enamelling activities throughout the world should be made available to all countries. The proposals were agreed to and it was decided that an international body should be founded by the *Institute de l'Email Vitrifie*; Institute of Vitreous Enamellers; *Nederlandse Keramische Vereniging; Afdeling Email; Verein Deutscher Emailfachleute,* and *Verein Osterreichischer Emailfachleute,* and that initially the body should be named the International Enamellers' Council.

ECSC to Award Research Scholarships

Up to five research scholarships, each to the value of 500,000 French francs (about £500) for a period of eight months, are to be awarded at the end of June by the High Authority of the European Coal and Steel Community. The purpose of the awards is to encourage research into the economic, legal, and social problems of European integration.

Candidates should, in general, be citizens of one of the ECSC countries (Belgium, Federal Republic of Germany, France, Italy, Luxembourg, and the Netherlands) or countries which have concluded agreements with the community, such as the UK, Switzerland, and Austria, or of member countries of the Council of Europe. Refugees from European countries not in the Council of Europe, but who are resident in a member country may also compete.

Suggestions for research subjects include:—The contribution made by the experience of the ECSC to the working-out and ratification of the treaties for the European Economic Community and the European Atomic Energy Community; the transition period of the ECSC; ECSC energy supply problems; long-term development problems in the coal-steel common market; trade unions; external relations.

Application forms, to be returned before April 30, may be obtained from the Information Service of the High Authority, European Coal and Steel Community, 18, rue Aldringer, Luxembourg.

Forty Years Ago

The leading article in the February, 1917, issue of this JOURNAL was devoted to the creation and significance of the Sheffield Association of Metallurgists and Metallurgical Chemists, probably because the formation of a club was envisaged. This Association was brought into being and operated successfully for many years, but it now meets at the premises of the British Iron and Steel Research Association. The reviewer found the gossip columns of this issue of forty years' ago of more interest than the technical. It was wartime, of course, and there was published a list of military honours awarded to foundrymen's sons, also a casualty list which would bring sad memories to the older generation. This issue reported amongst "new companies" the registering of the following: Midland Motor Cylinder Company, Limited; Edward Lucas and Son, Limited; and David Rowan and Company, Limited.

Mechanical Handling Exhibition

The Mechanical Handling Exhibition is to be held at Earls Court, London, from May 7 to 17. Occupying 500,000 sq. ft. of floor space, the Exhibition will for the first time be international in character. Over 250 exhibitors will be taking part and much of the new equipment displayed will include cranes, industrial trucks, lifters, conveyors, control equipment, and all types of accessories associated with mechanical handling. At the Materials Handling Convention, running concurrently, leading authorities will present papers dealing with the latest handling methods in particular industries. Further information, details of the many facilities available to visitors, and tickets, may be obtained from the exhibition manager, Dorset House, Stamford Street, London, S.E.1.

Canadian Hot-blast Water-cooled Cupola*

By J. E. Rehder

Mr. Rehder was born in Bowmanville, Ontario, where his family have operated an iron foundry since 1901. He graduated from McGill University, Montreal, and went on to an automobile factory in Windsor, Ontario. He spent several years as chief metallurgist for Canada of Grinell, Company, and later five years as a scientific officer in the Mines and Technical Surveys Department of the Dominion Government. In 1952 he became technical director of Canada Iron Foundries, Limited, of which, two years ago, he was made vice-president, Technology.

This account of the first Canadian hot-blast, water-cooled cupola to go into action (in a Toronto foundry) substantiates and elaborates claims made for similar plant in other countries. Operating advantages, it is claimed, are the flexibility with regard to raw materials which results from a more easily adjusted slag basicity, the economy in refractory maintenance made possible by shell water-cooling, the higher melting-rate, lower coke requirements and decreased melting losses brought about by the use of pre-heated air supply, the better control of iron composition and, finally, the diminished need for repairs and "patching." Whilst the initial installation cost was high, economies in operation will, it is believed, pay for this after a relatively short period.

The new hot-blast water-cooled cupola here reviewed has been installed in the National Iron Division plant of Canada Iron Foundries, Limited, Toronto, where fittings and centrifugally-cast iron water pipes are made, and it is designed to melt a maximum of 30 tons per hour. A new automatic charge make-up station handles the large quantities of charge materials involved. Although the cost of the complete installation was relatively high, the economies which it achieved are expected to pay for it in a reasonably short time. (General views of the cupola can be seen in Figs. 1-3.)

The object of water-cooling the shell of the cupola is to decrease refractory-maintenance costs, and there need be no refractory whatever in the cupola, above the tuyeres. Below the tuyeres, in the well of the cupola, where molten iron collects before being tapped out, a carbon-block lining is used; the cupola itself has a sand bottom. Since carbon is not affected or fluxed away by the molten slag which also collects in the well, it has a long life and the result is very low refractory cost.

Another important advantage of having no refractories in the melting zone above the tuyeres and neutral carbon in the well, is that any kind of slag desired can be used—acid, neutral, or basic—without effect on refractories; and furthermore a change from an acid to a basic slag can be made in a half hour while running. The reason this feature is so valuable is that in the last ten years it has become known that the nature of the slag in a cupola has a major effect on how the cupola operates and what raw materials can be used.

Operating Advantages

If a cupola is operated with a moderate amount of limestone in the charge so that the slag formed has more silica in it than lime, the slag is acid and there is moderate carbon pick-up, no desulphurization and relatively low loss of silicon. If, however, a considerable amount of limestone is charged as flux so that there is more lime than silica in the slag, the slag is basic and the cupola acts in a very different way. This, of course, presumes a lining in the cupola of basic (*i.e.*, magnesite or dolomite) brick since adding more limestone to an ordinary acid-lined cupola would simply dissolve more refractory, resulting in very rapid lining erosion and a slag remaining only slightly basic.

High Carbon Pick-up

With a basic slag being formed, not only is carbon pick-up very high but desulphurization is rapid and effective. Melting-rate is lower and more coke must be used, but tapping-temperature is higher. These effects are all related to the basicity of the slag, the more lime in the slag the greater the carbon pick-up and so forth, and the degree of these effects can be regulated by controlling slag-composition, from distinctly acid, through neutral, to very basic.

The use of basic-slag operation thus makes it possible to employ raw materials formerly impracticable. Cupola charges of 100 per cent. steel scrap can be melted to a carbon content of 4.00 per cent., with 0.03 per cent. sulphur, at a temperature of 1,595 deg. C., which with ordinary acid-slag operation would produce iron of 2.50 per cent. carbon, 0.20 per cent. sulphur, at 1.480 deg. C, an unusable metal. Almost complete flexibility in use of raw materials becomes possible, and by suitably adjusting slag basicity and operating conditions, the lowest cost charge materials can be used to make first-class iron. Such a cupola then is more than a simple re-melting furnace—it is a true metallurgical tool.

Higher Melting Rate

Another feature of the new cupola is that the air supplied to the tuyeres for combustion is preheated

* This article is reproduced by courtesy of the editor of *Canadian Metalworking*, its original title being "Pipe-maker instals Water-cooled Cupola."

Hot-blast Water-cooled Cupola

in an oil-fired recuperator to a temperature of 260 deg. C. This results in a higher melting-rate, a decreased coke requirement, and lower melting losses, and is economical on its own account since the cost of operating the air-heater is less than the savings made. This heater has been already described†, when it was applied to the standard acid cupolas formerly used. On strongly basic operation of the new cupola it will be an additional aid to producing higher melting-zone temperatures and more fluid slag.

The new cupola replaces two smaller standard cupolas, which had been used on alternate days. Only one cupola is now installed since refractory maintenance is expected to be very low and long runs can be made. The base plate and bottom doors are standard, as is well-construction and front slagging spout. From the level of the tuyeres up to nine ft. the shell is made of ¼-in. steel-plate with all seams vertical and welded, and the walls are inclined three degrees inward from vertical so that the top of this zone is slightly smaller than the bottom at tuyere level, 75-in. diameter at the top and 81 in. at the bottom. There is no lining of any kind inside this shell which covers the highest temperature part of the cupola.

Expansion Joint

At the top of this tapered section there is an expansion joint, and all higher construction is supported separately from this level on four columns which have their own foundations at ground level. It would therefore be possible to replace the tapered section if necessary without dismantling the cupola, since it carries only its own weight. Above the expansion joint is a straight section of shell, 12 ft. high to the charging door, lined with ordinary cupola block for the first six feet and with nodular-iron block for six feet below the charging door to resist abrasion from the charges. From the charging door to the top of the stack an ordinary steel shell lined with firebrick is used. The top of the stack of the new cupola is unusually high, being 126 ft. from ground level to help to dissipate cupola smoke and gases.

Lining Arrangements

It will be noted that while the inside line of the cupola is smooth and continuous from bottom plate to charging door, there are two outward steps in the exterior line. One is the well where the shell is 25 in. larger in diameter than the bottom of the tapered section to allow for the carbon block lining in the well. The other is above the expansion joint, where the shell is larger to allow for the brick and iron block lining up to the charging door.

The bottom of the cupola is covered with rammed sand as in an ordinary cupola. When extended runs of several weeks are entered upon—and such are quite feasible—the sand will be further protected with a rammed high-temperature neutral refractory. The well is lined with 4½ in. of ordinary firebrick for insulation, and then with 8-in. thick carbon block. This lining is carried up to just below the tuyeres but the well is not unusually deep.

The breast is rammed with a graphite-bearing refractory mix, and the front slagging-spout is lined with firebrick and carbon block. The receiving ladle is lined with acid brick. Slag is granulated in a trough with water and collected in a large perforated bucket. It is then easily handled and disposed of, making excellent road ballast.

Water-cooling System

The cupola shell is water-cooled from the expansion joint down to below the tuyeres by flowing water over the shell in a thin sheet. It is distributed around the shell by a wedge-shaped ring forming a trough, with a neoprene flange or lip which can be adjusted to make the flow even. Flow is entirely by gravity and two additional rings or troughs are provided between the top and bottom of the water-cooled zone, which help to keep the flow even. The object is to have a thin, uniform sheet of water flowing smoothly down the shell, in precisely the required volume so that the water does not steam at the bottom. Excess water does no harm but is wasted.

Some adjustment of trough lips is necessary during the first few hours or days of operation in order to provide an even water-sheet, but then only routine attention is required. The volume of water is regulated by a main valve, and is adjusted according to water temperature, but is generally about 270 gallons‡ per hour with a maximum water temperature of 120 deg. F.

The water flowing down the shell is collected in a moat or trough around the base of the cupola, and part of it is then used for slag granulation.

Tuyeres System

The eight tuyeres (see Fig. 2) are of fabricated-steel pipe with detachable copper noses where they enter the well. The tuyere noses are copper castings with water passages cast in so that each tuyere is water cooled. Although these copper castings are expensive, their life is long and of course no repairs or patching are necessary. In case of accident the nose casting can be readily taken off and replaced by a new one. The volume of water used to cool the tuyeres is about the same as for the shell. The exit water temperatures run lower, at about 80 deg. F.

Lower Coke Consumption

Operation of the hot-blast water-cooled cupola is the same as for ordinary cupolas, allowing for the change made principally by the use of 260 deg. C. blast. The hot blast produces a higher melting-rate, lower coke consumption and decreased melting losses than would be the case with cold blast, and the new cupola of 78-in. internal dia. will be able to melt 30 tons per hour at a coke ratio of 10:1 and spout temperature of 1,480

† *Canadian Metalworking*, April, 1957.

‡ Probably American gallons: one imperial gallon = 1.2005 USA galls.—Editor

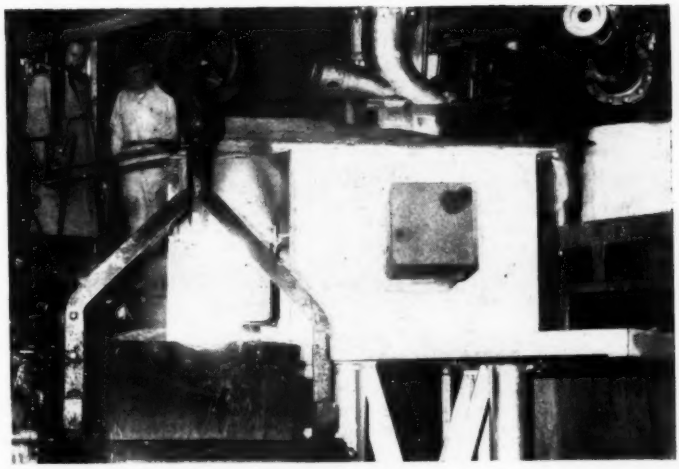


FIG. 1.—*A general view of the cupola recently installed in the National Iron Division plant of Canada Iron Foundries, Limited. The iron can be seen by-passing the mixing ladle directly into the crane ladle before being moved into the fittings foundry.*

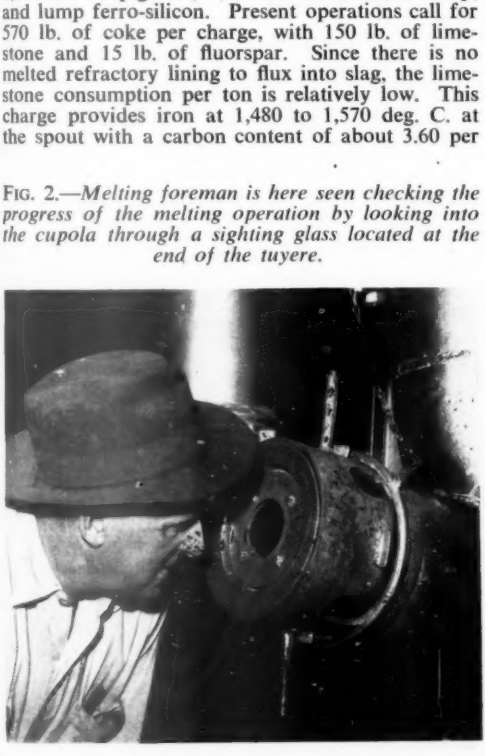
to 1,510 deg. C. At the present time and for the near future the melting-rate will be limited to 22 to 24 tons per hour at a coke ratio of 8 or 9 : 1 since that is all that is currently necessary.

More Uniform Control

One of the incidental minor advantages noted in the use of water-cooled shell is that since the operating diameter of course stays the same all day, the operating characteristics do not change as they do in a brick-lined cupola whose melting zone increases in diameter through the heat, and as a consequence control of iron composition is more uniform. At present a slag a little on the acid side of neutral is being used, with a metal charge of 1,000 lb. of pig-iron, 3,750 lb. of cast-iron scrap, and lump ferro-silicon. Present operations call for 570 lb. of coke per charge, with 150 lb. of limestone and 15 lb. of fluorspar. Since there is no melted refractory lining to flux into slag, the limestone consumption per ton is relatively low. This charge provides iron at 1,480 to 1,570 deg. C. at the spout with a carbon content of about 3.60 per cent. and silicon content of about 2.00 per cent. Iron for pipe needs relatively high carbon-content for best properties, and the present operating conditions are aimed at a suitable balance. It is expected eventually that a more basic slag will be used, resulting in decreased use of pig-iron, adequate carbon-content of the iron, and good control over sulphur-content to make an economical, high-quality product.

If, of course, the cost of steel scrap were to decrease, up to 100 per cent. steel scrap could be economically used to make high-carbon, low-sulphur iron, and advantage can also be taken of the lowest cost ratio between cast-iron scrap and steel scrap.

FIG. 2.—*Melting foreman is here seen checking the progress of the melting operation by looking into the cupola through a sighting glass located at the end of the tuyere.*



Minimum Patching Needed

Since the foundry is at the moment operating only one shift, the bottom is dropped every afternoon. The carbon lining of the well is quenched black with water immediately to minimize oxidation by the air, and the drop is quenched and cleared away as in normal practice. There is little to do on repairs, since the shell and well are clean and only the edges of the bottom of the well need chipping free of slag. The tap-hole is rammed fresh and the spout cleaned, and that is all until the bottom doors are to be put up and a new sand bottom installed for the next day. After six weeks of daily operation there had still been no patching necessary in the well and the carbon blocks looked as if they would last for years. Patching of joints with carbon paste, however, will be necessary.

In the near future the cupola will not be dropped each night but banked over the other two shifts with coke breeze. A cost comparison will then be made to see whether the coke used costs more or less than the labour and sand for a new bottom. When on two-shift operation, there is no question that banking over the third shift will be economical. Operation for a full week will then be routine.

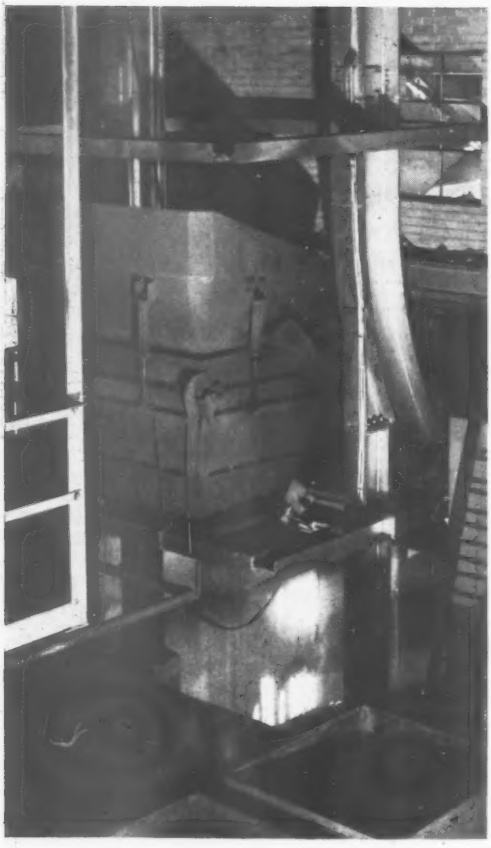


FIG. 3.—*Close-up of a section of the cupola, showing the bucket being hoisted to the charging door. The whole charging system is push-button controlled.*

When the new cupola was designed, a completely new charging arrangement was also laid out to decrease charging costs. This, of course, has no necessary connection with the water-cooling or hot blast and would apply to any production cupola. It is a skip-hoist charger with four-leaf bucket.

The charge make up was intended to be as nearly automatic as possible. A Browning diesel track crane with a magnet unloads trucks of pig-iron and scrap, and also fills a charge weigh-hopper which has a dial easily visible from the crane. The weigh scale used is electronic in operation with no knife-edges or levers, and maintenance is low. The hopper funnels into the charging bucket, and the charging bucket on its way to the cupola has coke and limestone added by belt over an automatic scale.

Saving in labour-cost of charging is considerable, amounting to 75 per cent., and more uniform charging is obtained than with the former method. The charging equipment costs more than the cupola but is well-justified economically.

Although the melting unit installed at National Iron Division is relatively large and has a melting rate larger than many cupolas in Canada, the economies to be had by using either hot blast, or water-cooling, or both, are not limited to very large cupolas. Hot blast is a practical money-saving practice for melting rates down to 5 tons per hour, although this should be continuous for a tonnage of at least 35 to 40 tons per day. It can be applied readily to existing cupolas without major changes, and as a matter of fact was installed at National Iron on the old standard cupolas over a year ago. Hot blast can be expected to pay for itself in increased tonnage, decreased coke consumption, and lower-cost charge materials.

Water-cooling of cupolas is becoming widely practised, and runs from simple use of a hose on a shell to prevent a hot spot forming, to a cupola specially designed for maximum benefit from water-cooling, as the one described above. Two systems are in general use, one involving water-cooled tanks on the inside of the shell from the tuyeres up from 4 to 6 ft., and the other simple flooding of the exterior of the shell with a twin sheet of water. The tank method is used fairly widely in England and on the Continent, but to a lesser extent in North America. Experiments some time ago at Canada Iron Foundries with tank water-cooling were not encouraging.

Decreases Lining

One of the advantages of shell water-cooling applied to an existing cupola is increased melting-rate due to the larger internal diameter which results from a thinner lining. By application of shell water-cooling to an existing cupola in one of Canada Iron's foundries, lining thickness decreased from 13½ to 4 in., and not only was refractory consumption decreased but the need for a new cupola for increased tonnage avoided.

(Appendix and further illustrations to be printed shortly—EDITOR.)

Mond Nickel Fellowships

The Mond Nickel Fellowships Committee announced recently the award of a Fellowship for 1957 to the following applicants:—Mr. E. J. Williams (John Summers & Sons, Limited) and Mr. R. J. D. Acheson (Mufulira Copper Mines, Limited), and now invites applications for Fellowships (of an approximate value of £900 to £1,200) for 1958. Fellowships will be awarded to selected candidates of British nationality with degree or equivalent qualifications to enable them to obtain wider experience and additional training in industrial establishments, at home or abroad, to make them more suitable for future employment in senior technical and administrative positions in British metallurgical industries. Each Fellowship will cover one full working year. Particulars and forms of application are available from:—The secretary of the Committee, 4, Grosvenor Gardens, London, S.W.1.

Parliamentary

Thermal Insulation Bill

In the House of Commons last week, MR. GERALD NABARRO (Con.) asked leave to introduce the Thermal Insulation (Dwellings) Bill. He said the purpose of the Bill was to provide for the thermal insulation of all dwelling houses built in the United Kingdom after 1959.

Of the 4 tons of coal or coal equivalent used for heating in an average house each year, he estimated that at least 25 per cent. would be saved by proper insulation of the house. Some technical sources claimed that the saving would be as high as 50 per cent. If 250,000 properly insulated houses were built in a year at least 250,000 tons of fuel would be saved.

Mr. Nabarro said he had been advised by architects that providing proper and efficient structural insulation was built into a dwelling house during its erection the cost of the dwelling would not be any higher.

Leave was given and the Bill was brought in and read a first time.

Machine-tool Industry

Questions regarding the machine-tool industry were put by MR. MAURICE EDELMAN (Lab.) and MR. ARTHUR CHAMPION (Lab.) to the President of the Board of Trade and the Minister of Supply, respectively. MR. F. J. ERROLL, Parliamentary Secretary to the Board of Trade, told Mr. Edelman that the President was aware of the deterioration which had taken place in the machine-tool industry, particularly in the Coventry area, but the reduction was not serious and he was in close touch with the industry through the Machine Tool Advisory Council.

In reply to Mr. Champion, MR. AUBREY JONES, Minister of Supply, said the sale of machine tools by direct private negotiation with individual members of the British Association of Machine Tool Merchants had been sanctioned because the tools, or similar ones, had been offered previously by auction or tender and the prices obtainable in direct negotiation were higher.

The following day MR. EDELMAN again raised the question of the decline in the machine-tool industry, when he asked the President of the Board of Trade what action was being taken to find new markets for the industry. SIR DAVID ECCLES, President of the Board of Trade, replied that in 1957 the industry achieved record exports.

Were not more special-purpose machine tools vital for British industry being imported than were being exported, MR. EDELMAN asked. Was it not a fact that a quarter of the machine-tool workers in the Coventry area are now facing redundancy? Pending nationalization, would Sir David take action to investigate the paradoxes of the situation?

SIR DAVID ECCLES: "I am not aware of this situation in the machine-tool industry, but I will look into it."

BOILER FEED PUMPS are to be supplied to the South of Scotland Electricity Board's new power station at Kincardine by the Harland Engineering Company, Limited, Alloa, under a £1,000,000 order.

THE HIGH AUTHORITY of the European Coal and Steel Community has fined an Italian steel company 10,000,000 lire (about £5,800 or $16,130) for failing to comply with the community's regulations on publicity for price-lists, payment of the community's levy on production, and payment of the scrap import compensation levy.

Presentation to Mr. Vincent Jobson

At a luncheon party in London recently the well-known industrialist Mr. Vincent Jobson, chairman and managing director of Qualcast, Limited, received a presentation from the Council of Ironfoundry Associations, to mark his completion of 53 years in the ironfounding industry, long service on its executive bodies and pioneering work in the organization of ironfounders in the United Kingdom.

Mr. Vincent Jobson (left) receiving the presentation from the Council of Ironfoundry Associations made by the chairman of the Council, Mr. N. P. Newman.

Mr. Jobson, who was 71 on January 22, is still fully active in the control and direction of his companies. The presentation was made by the chairman of the Council, Mr. N. P. Newman, chairman and managing director of Newman Hender & Company, Limited, engineers and ironfounders. It consisted of an inscribed silver salver and a set of cut-glass goblets.

POA Minibition and Conference

The Purchasing Officers Association is holding its ninth annual Minibition in conjunction with the National Conference at Southport from October 2 to 4. It will follow the pattern of previous years and the usual competition for the best stands will again be divided into two classes, educational and display. Last year, Shell Mex & B.P., Limited, were first in the educational class and Langley London, Limited, were first in the display class. Full details and reservation forms may be obtained on application to the secretary of the Purchasing Officers Association, Wardrobe Court, 146a, Queen Victoria Street, London, E.C.4.

The Association also announces that in conjunction with the Brussels Universal and International Exhibition, it is joining with other similar bodies in Belgium, France, Germany, Holland and Sweden, in sponsoring a short European Purchasing Conference, to be held at La Maison de l'Ordre de Leopold, 27 rue de la Science, Brussels, from May 8 to 10.

Equipment & Supplies

Control Instruments

Ether, Limited, of Tyburn Road, Birmingham, have announced additions to their range of control instruments which will be of interest to foundrymen.

The first is a temperature-controller, the Thermal-trol Type 750, which employs no galvanometer and has a wide range, being able to control temperatures between −200 deg. C. and + 1,000 deg. C. for electrical, steam-gas- or oil-fired apparatus. The instrument is not affected by vibration or ambient temperature and is suitable for wall or panel-mounting.

Also available are two flame-failure controllers which are entirely new in design and have a number of worthwhile and interesting features. Both are designed to combat running flame failure in gas- or oil-fired systems. The first of them, the type 700, is semi-automatic and the second, the type 701, is a fully-automatic relight unit.

The last of the new instruments is a temperature recorder which can record any number of independent temperature points from one to six. This instrument incorporates a conventional galvanometer, a chart and chart-drive mechanism, recording mechanism, automatic ribbon-mechanism and an automatic station selector and indicator, and it can be wall- or panel-mounted.

Hose Coupling

Airtech, Limited, of Haddenham, Bucks, have announced that the availability of a new hose coupling for use with low- and medium-pressure compressed air and fluids. These couplings are already in use in steel works, factories and coal mines throughout Europe and will be of interest to manufacturers and users of pneumatic tools, and to users of compressed-air, water, potable and other liquids.

The coupling has the advantage that, forming a one piece unit it need never be dismantled. No preparation of the end of the hose is required and no tools of any description are required for fitting or removing. It is exceptionally light in weight when manufactured in nylon.

Two types suitable for working pressures up to 250 lb. per sq. in. are available (Fig. 1), the first for joining two lengths of rubber or plastic hose together, the second for attachment to a tool, or to a supply point where the coupling can remain permanently. Similar couplings manufactured in brass will shortly be available.

FIG. 1.—*Hose couplings in nylon and brass for use with low- and medium-pressure compressed air and fluids.*

Fork-lift Truck

FIG. 2.—*"Reach" type fork-lift truck with forks extended.*

G. Hunter (London), Limited, of 80, Fenchurch Street, London, E.C.3, have announced a new fork-lift truck in which the forks "reach" forward to pick up a load and then withdraw to within the wheelbase. The lifting capacity is 2,200 lb. at 25-in. centres, and the fork-lifting arrangement makes possible the lifting and setting down of pallets and containers in front of the chassis. The appliance has, it is claimed, the important advantage that with a gangway of only 5 ft. 10 in. pallets 39 by 30 in. can be handled and that the actual weight of the truck being only 3,500 lb. it can, therefore, be used on different storeys. The fork-stacking arrangement permits also, access for loading in three directions from the platform of a lorry. During travel the load is within the wheelbase, which ensures travelling safety. This truck is at present being manufactured in Germany, and sold throughout the British Commonwealth.

SIR W. H. BAILEY & COMPANY, LIMITED, Patricroft, Manchester, have been appointed sole distributors for the flow-indicating equipment produced by the Dukes and Briggs Engineering Company. This equipment at present comprises their "Telicator" visual-flow indicators, although other models are shortly going into production. The "Telicator" unit is designed for high- or low-pressure systems, and high or low rates of flow at any viscosity. Comparative flow can be readily gauged by a glance at the rate at which a rotor in the unit is revolving—this rotor being clearly visible through its cartridge case of perspex or glass.

AN INDUSTRIAL VACUUM CLEANER which will pick up liquids has been introduced by the electrical equipment division of Martindale Electric Company, Limited, of Westmorland Road, London, N.W.9. Known as the Martinet wet-dry suction pick-up, this cleaner is suitable for a variety of purposes in metalworking shops such as picking up dirt, oil and grease from floors and machinery and assembly lines. Metal chips from machine-shop floors can also be picked up and salvaged.

Palletmaking Machine

A specialized type of woodworking machinery, designed by Matthew Wylie & Company, Limited, 71, Milnpark Street, Glasgow, has been produced to meet the increasing demand for pallets. The job of nailing and screwing the pallets together, an operation which usually takes 30 minutes, can be performed by the machine in under 90 secs.; it also pre-drills the holes. Mr. Matthew Wylie, who is going to Florida at the end of this month, is confident that there is a potential market in America for the machines.

Metallurgical Aspects of Hot-tearing in Cast Steel*

By Kurt Beckius

(*Continued from page 123*)

Having given a detailed account of his research into the formation of hot-tears in steel, the Author continues with an examination of the data obtained by the experiments and makes a comparison between his own findings and those of other workers in this field. His conclusions form the basis for a descriptive explanation of the actual nature of tear-mechanism and he ends his paper with a comment on the degree to which tests made under laboratory conditions will be paralleled by practical experience in the foundry itself.

Conclusions and Comment

The study has shown that hot-tears arise during solidification. The tearing process has been found, however, to be somewhat different than would have been expected on the basis of Pellini's film theory.[1] There is reason, therefore, to examine the basis of this theory more closely. As already mentioned, Pellini's theory is based on the fact that the difference in temperature between surface and centre of a section of a casting made in a sand mould is so small that liquid films exist simultaneously in the entire section of the casting during the hot-tearing stage. The difference in temperature between the interface mould wall-steel and the inner portion of the solidification zone is, according to Bishop, Brandt & Pellini,[2] maximum 50 to 60 deg. C. in a section 175 by 175-mm. thick during the greater part of the solidification in steel containing about 0.60 per cent. C. The solidification interval in the equilibrium diagram is about 60 deg. C. for this carbon content. Pellini counts on a difference of temperature of maximum 6 deg. C. between surface and centre in the casting used in his hot-tear experiments, the thickness of which was 12.7 mm.

The Author's measurements suggest a temperature differential of the order of 50 deg. C. at the start of measuring, and this difference increases with time. A difference of this order would mean that the conditions for Pellini's theory might possibly be fulfilled at the higher carbon content, but not at the lower where a solid surface-layer would instead arise before the solidification had reached the centre. In view of the rapid cooling that takes place in such thin sections it appears improbable that the difference in temperature would be as small as indicated by Pellini. The difference of > 50 deg. C. obtained in the 15-mm. thick test-bar employed in the present experiments suggest that the difference of 6 deg. C. indicated by Pellini is too small. In his discussion Pellini does not take into account the large difference in thickness of the solidification zone occasioned particularly by variations in the carbon content.

To base the explanation of the hot-tear mechanism on such uncertain observations as are provided by surface temperature measurements appears unsatisfactory. It would, therefore, seem to be necessary to test the correctness of Pellini's theory from other points of view.

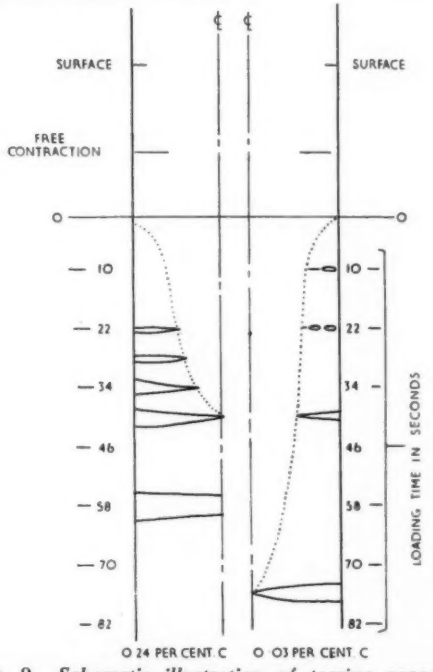


FIG. 9.—*Schematic illustration of tearing process in test-bars, type A, as found in tests with the spring load removed after varying lengths of time.*

If the condition for his theory, that molten metal must exist right out on the surface when tearing starts, is fulfilled, the first tears must arise at the surface. Such tears will initially develop from the outside inwards, so that at an early stage they would be widest at the surface where the contraction stresses have been active for the longest time, and would narrow down nearer the centre. Examination of the appearance and process of the tears, how-

* Abstracted from a paper presented at last year's International Foundry Congress held in Stockholm.

ever, shows that early-developed open tears are wider below the surface and often do not reach the surface. This proves that they have *not* formed at the surface and have *not* expanded from the outside inwards. The study of tears in their early stages shows, instead, that they start to form a little inside the surface and then extend in both directions, so gradually reaching the surface. The observation that filled tears in non-loaded specimens are equal in width suggests a similar explanation. This has been observed especially clearly at low carbon contents.

The only explanation of the observed tear formation is that a thin, completely solid shell of metal is formed before the tears start to develop. This shell may be expected to be very thin, so that it may readily be strained to rupture if its thermal contraction is obstructed. If this happens, rupture should most easily occur on the inner side of the shell where the temperature is higher and the shell, owing to its dendritic mode of solidification, has many weak points. A tear arising in this manner should comply in form and location with the observations which have been made.

Comparison of Procedures

The facts established above, and under the heading "Character of tears and structure," in regard to the successive nature of the tearing process are illustrated in Fig. 9. This figure also shows the difference between the process in bars with 0.24 and 0.03 per cent. C. The investigation has shown that the hot-tear mechanism is altogether too complicated for comparisons of the susceptibility by the method practised by Middleton & Protheroe,[3] Bhattacharya, Adams & Taylor[4] and Heyer & Piwowarsky,[5] to be considered satisfactory. The method they adopted was to read from the deformation curves the loading values at the transition from contraction to expansion. The point at which this takes place represents a very late stage of tearing. The earlier stages of the process, which are far more important to the assessment, are inaccessible. This would appear to have been realized by Middleton who, in later investigations, discarded this method of comparison and instead compared the length of tear and the loading values at three points of time which were calculated to lie within the interval in which the cracks develop according to Pellini's theory and recordings of cooling curves. Heyer & Piwowarsky instead aimed at as rapid and early a total fracture in the bar as possible, which gives evidence of incomplete analysis of the solidification and tearing process. This may also be said to apply to the procedure chosen by Bhattacharya, Adams and Taylor.

From comparisons between the extent of tears in sawn test-bars and the contraction curves, however, the susceptibilities to tearing of different alloys can be read from the shapes of the curves during the later stage of tearing. It may therefore be of value to compare the present results in certain of their aspects with those of Middleton and Protheroe and other workers.

In the investigation of the pouring temperature, the only case treated is that in which its influence on the decomposition of the mould has been eliminated. The general opinion in the literature is that a high pouring-temperature makes the steel more susceptible to tearing. This view is supported by the present investigation, in which particular attention has been paid to the importance of the character of the crystal structure. Middleton's investigations indicate that, in cases when contraction is opposed mainly by the mould, the influence of the pouring temperature on the decomposition of the mould material has a greater significance than its influence on the steel. The reason for this conclusion is that a linseed-oil bound core, which produced more tears in a small test-specimen at high pouring temperatures, caused no tear in a larger specimen at high pouring temperatures.

To assess the influence of the carbon content and other alloying elements, a comparison should be made between similar crystal structures, *i.e.* when pouring at roughly the same excess temperature. This may possibly explain why Middleton and Protheroe found a greater susceptibility to tearing in steel of higher carbon contents, as they made their comparisons at constant pouring temperature. Their observation was that an increase in phosphorus from 0.035 to 0.090 per cent. causes a deterioration in resistivity at lower pouring temperatures, but not at higher, points in the same direction. At the higher pouring temperature the bar has a great tear-susceptibility owing to the structure, irrespective of the phosphorus content, whereas at lower temperatures there is an opportunity for the deteriorative effect of the phosphorus to become noticeable.

The location and appearance of the slag inclusions on deoxidation with different aluminium contents have been found to conform with the findings of other authors. The parallelity between the form and location of the inclusions and the tearing tendencies is also in agreement. A knowledge of this relationship between tear-susceptibility at freezing temperature and character of the inclusions at room temperature suffices from the practical point of view. It must be clearly understood, however, that the knowledge of the real process of precipitation of the slag inclusions during freezing is incomplete.

As regards the hot-tear risk, the tapered junction of test bar type B is a better design than type A. This is apparent from the fact that the cracks in type B occur elsewhere than at the junction. The reason why cracks do not form in the tapered portion should be that the strain is distributed over a comparatively long zone with delayed freezing.

Hot-tearing Mechanism

The data from the investigation provide the following explanation of the hot-tear process, limited initially to the cast test-bars. The explanation conforms with that proposed by Hultgren, in a paper by Helmer[6] in respect to surface cracks in steel ingots. When the poured steel comes into contact with the walls of the sand mould, a very thin shell of solid steel forms adjoining them which,

as the steel rises in the mould, becomes continuous from one end of the bar to the other. The shell quickly forms also in the chill in the base-plate of the test apparatus and around the steel bolt in the end of the test-bar. Owing to the cooling through the walls of the mould, the shell will steadily fall in temperature and so contract.

When this contraction in the solid shell takes place freely, *i.e.* unhindered by a spring, the bar is locked in position only at the gating end and therefore draws together in the direction of the gating. If there were no friction between the wall of the mould and the steel shell, this contraction would proceed unobstructed without any stresses, or the resulting strains, arising in the shell. In the event of sufficiently great friction, the shell would instead be locked at every point on the contact surface, with all movement of contraction replaced by a uniform strain along the entire shell. In neither of these cases would tearing be expected. Without a more exact knowledge of the location and nature of the boundary between these two separate patterns of behaviour caused by friction, it may nevertheless be said that the resistance actually caused by the friction results in stresses in the shell and less movement of contraction than would be expected if no friction existed.

Governing Factors

The stresses must be taken up by the shell through its ductility if fracture is not to occur. As long as the shell is thin, and there is good contact between the mould wall and the steel, the stresses may lead to tears in the shell. The occurrence of tears in the junction is a natural outcome of the shell being thinnest at that point. The resulting tear may continue out to the surface, but does not always do so. The governing factors are the ductility of the shell and the magnitude of the resistance to contraction. If the resistance is overcome at a certain shell-thickness, the tearing ceases.

Tears of this kind may arise at various points in the ring-shaped section through the junction, which constitutes the weakest part of the shell. Owing to the hydrostatic pressure and capillary forces, however, they will be filled with molten metal which is pressed in from the liquid steel inside the shell almost at the same instant as the tears develop. The forced-in melt solidifies on contact with the solid metal in the tear surfaces, but, because of its less pure composition and its situation between the dendrites, it constitutes a renewed zone of weakness. This formation and filling of the tears may be repeated several times during the progress of solidification, with tears arising at new points of weakness or continuing in the previous ones.

As the temperature falls, the solid shell becomes thicker and its outer portions stronger. If the resulting stresses are caused solely by the friction operating on the outer surface of the shell, the strength of the shell may fairly quickly become sufficient to take up these stresses under expansion without tears developing. The continued contraction and solidification of the bar will take place without tear-formation, and the cooled bar will probably contain no open tears. This process has been observed both in 15- and 20-mm. thick bars in which the external, filled tears end about 4 mm. inside the surface and no tears, either open or filled, occur at a greater distance from the surface.

Points of Weakness

If the contraction is restrained by the resistance of a spring, the force of friction will be augmented by a force directly proportional to the contraction. This entails no alteration in the time of occurrence of the first tears, since the force of friction alone is sufficient to cause rupture at that stage. The contraction is in any case initially slight. The spring does, however, lead to more active tear-formation which continues further into the bar and gives rise to ruptures at several points of weakness, and to open, permanent cracks. This is because the stresses in the bar, which are spread over a cross-sectional area which increases with the growth of the shell, continuously grow more quickly than the shell increases in strength.

The occurrence of cracks which by turns open and are filled with melt will thus continue despite the fact that the solid shell becomes thicker and stronger. As the solidification proceeds, the supply of molten metal to tears or parts of tears situated near the surface will become increasingly difficult and, finally, impossible. Therefore the zone of solidification, as it moves inwards, will leave behind open tears which gradually expand and grow in the interstices between the crystals where the enriched portions of late-solidified melt make the structure weakest.

In a columnar structure tears, once formed, expand very readily between the dendrites inasmuch as the latter grow rectilinearly and in parallel. In a test-bar in which the columnar crystals in the tear region penetrate as far as the centre, the tears will develop and expand on the same pattern, as long as the metal remains molten. In such a test-bar the structure will offer but little resistance to the expansion of the tears, which will result in a practically simultaneous splitting over the entire periphery of the test-bar, at this stage almost finally solidified. This is revealed by a greatly reduced rate of contraction. When the stresses in the bar have been relieved by the splitting in the tear zone, the bar returns to its previous rate of contraction.

If a zone of equiaxial and/or nuclear crystals arises inside the columnar zone during solidification, it implies that no dominant orientation of the crystals occurs in this region. There is, consequently, a possibility that liquid films of critical thickness will arise over the larger portion of this still incompletely-frozen section. If this metal in the centre is exposed to strain, tears develop with their main direction perpendicular to the tensile direction, which is natural since the lines of weakness of the structure, *i.e.* the intercrystalline spaces, are less fixed in orientation than in the columnar zone in which the crystals grow largely at right angles to the mould wall. Since the directions of the equiaxial crystals alternate, the tears develop where the direction is " favourable " in relation to the direction of

the tensile stress. When a tear meets a "less favourable" crystal direction, it usually stops growing. A new tear instead forms at a "more favourable" point.

In a bar of overwhelmingly nuclear structure this form of tearing will predominate and "islands" of cracks will occur at different distances from the surface, whereas the cracks emanating from the columnar zone, if existent, will be short. The continued expansion of the tears in a structure of this kind is distributed over a larger number of separate cracks, so that the resulting rate of contraction successively diminishes, as indicated by the rounded contraction curves. The change in rate of contraction, when the outer tears open the surface layer, becomes even less accentuated, as also the removal of load from the bar. In structures intermediate between the purely columnar and nuclear the tear pattern is composed of the both to an extent which is determined by the spread of the different crystal zones.

If tears have arisen during solidification, it is unlikely that new tears will develop after the entire tear region has solidified. The weakest portions should be the intercrystalline spaces adjoining the ends of tears already existing. If the stresses in the bar exceed the limit of ductility of the metal, the expansion necessitated thereby will take place rather in the form of an extension of developed tears than through the opening up of new ones. If the design of the bar is such that no cracks arise during solidification, *i.e.* if the ductility absorbs the hindered contraction in the bar during the period in which certain parts of the steel are liquid in the critical region, there is no reason to suppose that the condition would be changed when the whole bar has solidfied. Thus in neither case do tears arise in the finally-solidified bar.

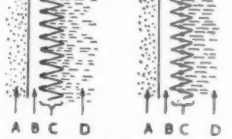
Depending on the ductility of the steel in solid state at temperatures immediately below solidus, the expansion of tears under continued loading will gradually cease or will continue until the bar breaks. Compared with the actual tear formation, the expansion of tears is naturally a secondary phenomenon of lesser significance. A fairly accurate examination of the latter's rôle in the tearing process has been necessary, however, both in order to elucidate the implication of the different stages of the contraction curves and to separate the effect of expansion from the primary tear formation. As will be apparent, the above account of the hot-tear mechanism is based, like Pellini's theory, on the notion that films of molten metal function as a tear-provocative medium. This is also a film theory, therefore, but different from Pellini's in its different conception of the solidification process. It is possible that the latter process, in alloys with very large solidification intervals, will be of such a nature as to make the adoption of Pellini's alternative conceivable.

Influence of Carbon Content

To explain the difference in tear-susceptibility between steels of different carbon contents, attention must be paid both to the varying magnitude of the solidification interval and to the peritectic reaction. It is known that hot-tears do not occur in the casting of pure metals and eutectic alloys, which solidify at constant temperature. It has been suggested in the literature on the subject that the hot-tear susceptibility of alloys grows with the magnitude of the solidification interval. The reason is stated to be that the tendency to formation of isolated films of melt between the crystals increases with the width of the solidification zone. This explanation appears plausible and serves very well for the mode of operation of phosphorus and sulphur among other elements. It does not, however, fully cover the observation made in regard to the influence of the carbon content in steel.

As shown both by the results of the experiments described above and by experience derived from steelmaking and foundry practice, the tear risk is greatest at 0.20 to 0.30 deg. C. The assumption in regard to the rôle of the solidification interval is fully compatible with the observation of reduced risk at lower carbon contents, but does not fit with the finding of improvement at higher carbon contents. If, however, the peritectic reaction is ascribed to a certain influence towards increased tear-susceptibility, the conditions can be better co-ordinated.

At carbon contents below 0.10 per cent. the solidification interval is comparatively small, implying a narrow solidification zone, so that the inner surface of the frozen steel is fairly smooth. Its notching effect is consequently small, and any cracks which arise should be readily filled in. Greater stresses would be required to tear apart a shell of this structure as compared with a shell in



A sand mould, B solid steel, C solidification zone, D melt. The black, marked spots show where the peritectic reaction is assumed to take place.

FIG. 10.—*Schematic illustration of probable influence of the peritectic reaction on the character of the solidification zone at* (*a*) *about* 0.20 *per cent. C.*, (*b*) *about* 0.45 *per cent. C.*

which the dendrites are long and narrow. According to Hall's investigations,[7] moreover, the strength and ductility of low-carbon steel immediately below solidus are high in comparison with the figures for other carbon contents.

Alloys containing 0.18 to 0.32 per cent. C., which have been found very susceptible to hot-tear, undergo a peritectic reaction—at least according to the equilibrium diagram—in which solid δ iron reacts with the remaining melt to form γ iron. This is associated with a change in volume contingent upon the transformations $\delta \rightarrow \gamma$ and liquid $\rightarrow$ solid phase. If this change occurs when small quantities

of melt remain, it is probable, as pointed out by Caine[8], that it may lead to increased tearing due, for example, to increased notch sensitivity and impaired feed in the innermost inlets of the dendrites where the reaction takes place.

If the peritectic reaction takes place during an earlier stage of solidification, as is the case with higher carbon contents, the reaction proceeds in wider "inlets" and any cracks that arise should be filled by residual melt. The difference envisaged in the appearance of the solidification zone, when the peritectic reaction occurs towards the end and in the middle of solidification, is illustrated in Fig. 10. Moreover, when cooling following pouring takes place too quickly to permit the establishment of equilibrium conditions, it is conceivable that the peritectic reaction occurs to only a very small extent at carbon contents closer to the ends of the peritectic line. Thus the resistance to hot-tear would be improved by the elimination of the calculated harmful effect of the peritectic reaction more than it would be impaired by the increasing solidification interval.

The probability that the peritectic reaction would fail to occur is perhaps greatest at carbon contents close to 0.10 per cent. If, because of undercooling, the δ phase continues to precipitate along the extension of the line A-H in the Fe-C diagram, the favourable conditions attaching to carbon contents below 0.10 per cent. will persist at higher carbon contents. The $\delta \rightarrow \gamma$ transformation will then not start until all melt has disappeared. If the peritectic reaction does take place it should from one point of view have a favourable effect. The residual melt that participates in the reaction will, in such a case, solidify at a constant temperature. It is doubtful, however, whether this factor will be operative.

A factor which has hitherto been considered only when discussing the lowest carbon contents is the differences, observed by Hall, in high-temperature strength and ductility of steel of different carbon contents. Between 0.20 and 0.50 per cent. C. the difference in these properties is negligible compared with the difference between 0.05 and 0.20 per cent. C., and variations of this kind should therefore be of subordinate importance above 0.20 per cent. C.

Conditions in Practice

The conditions in the foundry are naturally more complicated than in the laboratory in which the attempt was made to isolate the effect of the metallurgical factors. Depending on the construction of the casting and the resistance of the mould sand at the temperature in question, the stresses in the parts in which a hot-spot occurs will be greater or less than in the test-bars.

The mechanism of tearing in test-bars, the contraction of which is restrained by springs, should be applicable to actual castings of similar shape. The castings considered are such as contain T or L sections, flanges of similar parts so designed that contraction is obstructed in neighbouring parts and the strain concentrated to an adjacent hot-spot. The extent of tearing will depend on the degree of concentration of the hot-spot and on the amount of resistance to contraction.

Hot-tears occur also in large solid castings. In constructions of this kind, as also in ingots, the conditions more resemble those prevailing when the contraction is prevented only by friction. The similarity is confirmed by observations made of the character of tears in such castings. As in ingots, it happens that castings of such types are exposed to increased stresses due to local unevennesses in the mould wall and hangings, so that the tearing mechanism can proceed further than it would as a result of friction alone. The resistance set up by the mould material is of a different character to that deriving from a spring or other appliance for hindering contraction. The mould material causes an increase in resistance only up to a given limit, followed in some cases by a reduction, for example, when the mould material softens or disintegrates under the influence of temperature. This applies equally whether the mould material exercises its influence through friction alone or through a compression effect of the type arising from a flanged rod.

For the purpose of avoiding hot-tears in practice, it is naturally important to choose a design of casting, mould material, and location of feed and gate system such that tear-producing stresses are eliminated. If such stresses occur in spite of this—and it is usually unavoidable—the risk of solidification tears can be diminished, and possibly eliminated, by a suitable choice of steel composition, deoxidation-process and casting conditions.

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THE NEW FACTORY of the Caterpillar Tractor Company, Limited, at Glasgow is now nearing completion, and it is expected that the company will be manufacturing their first British-built D8 tractors there by the middle of this year. The factory, which occupies a 65-acre site and has 13 acres of floor space under one roof is claimed to be one the largest single buildings in Britain. Some of the London staff, headed by Mr. D. F. Sloan, manager of the sales department, have moved to the Glasgow office at 1, Newton Place, in order to maintain closer contact with the new factory.

AMENDED RULES making minor changes in the arrangements governing Patents applications and fees were laid before Parliament by the Board of Trade last Thursday week. They include the introduction of a new service to the public by which information will be supplied as to whether any particular Patent is in force on payment of a nominal fee of 1s. for the first patent and 6d. for each succeeding one. This service will replace, and will, it is hoped, be an improvement on, the former annual publication of the "List of Patents in Force."

Midlands Productivity Conference

Sir Edward Boyle, Parliamentary Secretary to the Ministry of Education, said recently that Britain still had an enormous reserve of technical skill to stand it in good stead and that one of our main exports should be modern inventions.

He was speaking in Birmingham at a regional productivity conference which was attended by some 200 delegates from industrial firms and trade unions. Companies should, he said, be prepared to release more of their qualified technical staff to teach part-time at technical colleges. There was still too much wastage of manpower in certain parts of British industry. Colleges should be able to look to industry for more help with the promotion of research and consultant work. The keynote of the future was the forging of closer links between technical colleges and industry and between technical colleges and secondary schools. Of some 6,500 qualified technologists produced in this country every year, nearly three-quarters derived their training from part-time classes in technical colleges.

Mr. Lewis T. Wright, chairman of the British Productivity Council, said that if Britain increased productivity by only five per cent. the nation would quickly defeat all its inflation problems. But, he added, there seemed to be no proper sense of urgency about the issue. Mr. Wright warned his listeners that tougher days lay ahead. Industry must remember that when the European Trade Area came into operation inefficient factories would go out of business.

Factors to Increase Output

Mr. James Crawford, the well-known productivity expert, also addressed delegates and dispelled the myth of the West German worker being a more effective producer than his British counterpart. Mr. Crawford said that while the German worker had slightly more capital equipment to work with, the British workman still held the lead in production per head in manufacturing industry. West Germany, although so much had been heard of its impressive post-war recovery, was not Britain's only Continental competitor to watch, he said. In Australia productivity had been increased by 3 per cent. in 1952, 4 per cent. in 1953, 8 per cent. in 1954, 6 per cent. in 1955 and 5 per cent. in 1956. Advances in Italy had been even more marked and France had also seen tremendous industrial growth with productivity steadily rising as it had, too, in Belgium and Holland. What was happening in Europe was also happening in India, Ghana, Burma, Nigeria, and the Middle East. But in Britain the annual rate of increase since the war had been only about 3 per cent., a figure far short of what was needed and indeed of what was within the nation's power.

Mr. Crawford suggested that three factors were important. First, flexibility of mind and outlook was needed reinforced by a free exchange of ideas among firms. Second, realization that work study in the hands of trained management and used with the support of operatives was one of the most effective tools in raising productivity. Finally, more shift work was needed. In the metal industry 42 per cent. of operators work shifts; in engineering 6 per cent. There was strong evidence that the position with regard to the amount of shift work was different in Germany and America. Britain ought not to have equipment standing idle for 60 to 75 per cent. of its life.

The Lord Mayor of Birmingham, Alderman J. J. Grogan, welcomed delegates to the conference which was organized by the Birmingham Productivity Association.

Smoke Abatement—Nonsense?

Doubts were cast on the health value of smoke abatement by Dr. R. C. Webster, Medical Officer of Health for Accrington and Darwen, at the meeting of the Royal Society of Health at Leeds on January 22. Following an account by Mr. H. J. Wyatt, deputy chief public health inspector for Leeds, on the work done in Leeds for smoke abatement in the past year, Dr. Webster asked, "Are we wasting an awful lot of time and effort in getting clear blue skies over cities like Leeds? Are we living in a fool's paradise when we think it is going to have any effect on health?"

Dr. Webster argued that whereas smoke abatement research was devoted to the removal of carbon from smoke, carbon was not dangerous to health, although it did dirty curtains and washing. But the hydrocarbonates which were present in smokeless fuel and in motor-car exhausts, and in the smoke from atomic reactors, were dangerous. He added, "I am not at all sure that all this bally-hoo about smoke pollution is not purely eye-wash and a waste of public money. Where there's muck, there's brass, and I am not at all sure we are not wasting that brass. Smoke abatement looks nice, but is it good?"

In a comment, Mr. Wyatt said he was sure that if they had cleaned up the atmosphere, there would not have been the smoke fog a few weeks ago, which caused the lights to be put up in the middle of the day. He stated that the inefficient burning of 476,000 tons of coal in domestic grates was without doubt the greatest single cause of air pollution in Leeds. In the city centre the estimated cost of conversion of appliances would be £28 10s. a house. The Corporation would pay seven-tenths of the cost. He went on to say that the reduction of the total smoke in heavily-populated areas by 80 per cent. in the next 10 to 15 years must be aimed at, and if it could be achieved it "would change the appearance of Leeds beyond recognition."

Power Convention, 1958

The tenth British Electrical Power Convention is to be held at Brighton from June 16 to 20 under the presidency of Sir George Nelson, BT. As in former years, an Electrical Exhibition will be held in conjunction with the convention and it will be opened by the president on the evening of June 16.

With the theme "Electricity and World Progress: Britain's Contribution," the first session will be held in The Dome on the morning of June 17, when following the civic welcome from the Mayor of Brighton, Sir George Nelson will deliver his presidential address. In the afternoon Sir Christopher Hinton, K.B.E., F.R.S., D.SC., will present a paper on "Development of Nuclear Energy for Electricity Supply in Great Britain." Wednesday's proceedings will begin with an address on "Development of Nuclear Energy for Electricity Supply Overseas," by Sir Claude Gibb, K.B.E., F.R.S., D.SC., and recommence in the afternoon with a paper by Mr. H. J. Beard on "Britain's Part in Electrical Development Overseas." Attention will will be centred on hydro-electric matters and the domestic use of electricity in Thursday's proceedings, when three members of the English Electric Company, Limited, will present a paper entitled "British Hydro-electric Plant and World Power Requirements." On Thursday afternoon Mr. J. I. Bernard, B.SC., will speak on "Development of the Electrically-equipped Kitchen," and the day's proceedings will conclude with the annual dinner/dance at the Corn Exchange.

Casting Iron Cannon

By F. Evans, M.B.E., M.A. Cantab.

Whilst there appears to be no English description of the method used in casting iron cannon it is clear that they were originally cast with a hollow bore which was afterwards reamered clean. In later times this was replaced by the technique of casting them solid and drilling out the bore. There followed, in about the 16th century, cannon made-up of wrought-iron bars hooped and welded together about the bore. The absence of more precise information is probably due to the custom among craftsmen of those times of keeping to themselves their trade secrets or, as they would have called them, their "mysteries."

The method followed in casting iron cannon can be deduced from the guns surviving, such as the "Irish guns" on Tower Wharf made by John Fuller in the 18th century (Fig. 1); from a description in French of the same period; and from the few remains found in the Weald of broken moulds once used in cannon founding.

The debt of the Wealden iron industry to French techniques is well-known. It was from France, in the 16th century, that the blast furnace came and it is obviously true that any advance in the work of the foundries made in France soon became known to the Wealden ironmasters some of whom were of French origin. Indeed, in the reign of Henry VIII, many guns for the defence of this country were cast in Calais which was then an English possession.

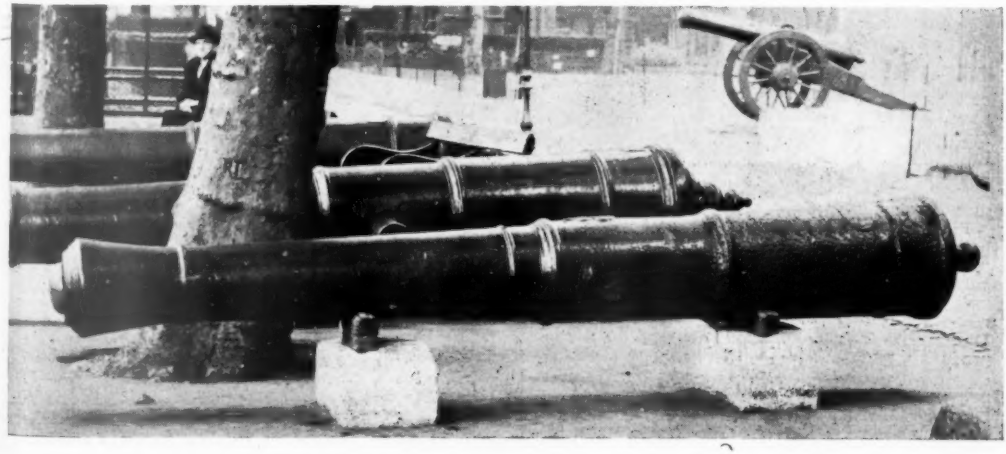
A Specialty of England

It is clear that the casting of guns in iron became a specialty of England in the 17th and 18th centuries and a lively export trade in them sprang up, English cast-iron guns being prized because of their quality. It seems likely that the casting of large guns in iron developed from the earlier casting of small guns in bronze (or brass as it was always termed). The technique of making these was, in turn, developed from the skill of the mediæval bell-founders.

Thus, it is not surprising to find that the making of the gun-mould for cast-iron followed the bell-mould idea to a large extent, that is, the mould was one made of loam and not of sand. First a full-sized model of the gun was built upon a wood spindle. This spindle was octagonal in section, similar in length to the gun to be cast and tapered to the same degree. This wooden understructure had cross bars or toggles fixed at each end to enable the whole to be revolved by hand on a pair of rigid bearings. Around this middle piece, twisted bands of hay were wound in spiral layers. Over these came coats of successive dressings of a mixture of clay, hair and manure, each coat being dried off over a fire. The layer of hay served to enable moisture to escape during the drying.

When the approximate shape and size of the gun to be cast was reached, the final coat of loam (clay, hair and dung mixture) was turned against a strickle, cut to the exact external shape of the finished gun. The trunnions, badges and other ornaments on the gun were then modelled separately and stuck on the dummy shape. When dry the model was covered by a coat of fine ash to prevent the adhesion of the outer mould to be made from it. This was made of several layers of loam held in place by wires and thick outer coats of clay. When all was quite dry, the centre spindle was taken

FIG. 1.—*Guns cast at Heathfield, Sussex, in the eighteenth century and now lying on Tower Wharf, London.*



Casting Iron Cannon

out and then the gunshape in the baked loam buried muzzle upwards in the ground alongside the furnace.

Making the Core

The model for the bore of the gun was formed by using an iron rod as a foundation. Around this, the wire was wound to a diameter of a little less than the bore and this was then coated with clay and the whole turned, when wet, against a straight-edged "former" down to the correct calibre of the gun to be cast.

This model for the bore was, when dry, then put down into the outer mould and, at the lower or breech end, centred by a loose iron chaplet or distance-piece with three arms. This remained embodied in the casting when the model for the bore was withdrawn.

This method of making the cannon bore was a very delicate operation and was only possible with highly-skilled and conscientious workmen. Guns were frequently rejected by the government owing to their bores having been cast out of centre. Thus boring out the gun from a solid casting became the method and, in Sussex, appears to have started in the 17th century.

At the top of the mould, a rough funnel-shaped "gunhead" was modelled so as to give the molten iron a "head" of liquid metal to fill the gun-mould free of air; to allow a place for the slag to float to the top and away from the gun itself; and to allow for any contraction of the metal on cooling. This gun-head was afterwards sawn off the real casting and melted down again in the furnace. This method of gun making, used for almost all muzzle-loaders, persisted well into the 19th century when more powerful explosives came to change the method into that which is used to-day.

The quality of Weald-cast guns—up to 32 pounders—was famous and perhaps the tenacious Sussex clays—especially the Wadhurst Clay—were especially suitable for shaping the loam patterns and making the moulds.

THE LEIPZIG SPRING FAIR 1958, will take place from March 2 to 11. Over 9,000 exhibitors from 40 countries will be represented on a stand area of about 3,000,000 sq. ft. The products on display are divided into 55 trade groups comprising both capital and consumer goods. Visitors from 80 countries are expected.

ENGLISH STEEL CASTINGS CORPORATION, LIMITED, Sheffield, are to make 278 four-wheel Commonwealth type one-piece cast-steel bogie frames for Metropolitan-Vickers Electrical Company, Limited, in connection with an order for 135 electric locomotives for South African Railways. Metropolitan-Vickers are making the traction motors and auxiliary machines.

THE MINISTER OF EDUCATION, Mr. Geoffrey Lloyd, will open the new Apprenticeship Training School of Guest Keen & Nettlefolds, Limited, Smethwick, on March 19.

BRITISH, AMERICAN AND DUTCH REPRESENTATIVES took part in the handing over at Bitteswell Aerodrome, on January 23, of the last of 22 Seahawk jet fighter aircraft built by Sir W. G. Armstrong Whitworth (Aircraft), Limited, of Coventry. Mr. H. M. Woodhams, managing director of the firm, handed the log-book to Mr. K. H. Jeffrey, Ministry of Supply, and among others present was Commander Leetouwer, director of the Netherlands Air Material Department.

Centri-spun Castings

The illustration shows centri-spun castings in ordinary and heat-resisting grades of stainless-steels made by Firth-Vickers Stainless Steels, Limited, for the powerful new Rolls Royce Avon (200 series) engine now being fitted in many of Britain's high-performance aircraft. The centri-spun components, 16 of them, range in size from a small housing to a nozzle box and outer casing and combine reliability with economy, hitherto unknown in such items made as forgings.

Firth-Vickers has extensive experience of this type of casting for the aeronautical engineering industry and first began its development of the centri-spinning process as long ago as the early 1930's. During the last war the company produced some 1½-million valve sleeves by this method. It also manufactured a number of centrifugally-cast components for Sir Frank Whittle's first jet engine.

Notes from the Branches

Lancashire

A meeting of the Lancashire branch of the Institute of British Foundrymen was held at the Midland Hotel Manchester, early last month when a paper entitled "CO_2, and Why," was read by Mr. A. Kirkham, B.SC. Mr. E. Beech, the branch president, occupied the chair, supported by the secretary, Mr. F. W. Nield.

Mr. Kirkham said the introduction to his paper read like a fairy-story, for the CO_2 process actually started in Lancashire many years ago. Andrew Polson—a moulder—saw the possibilities of CO_2 and many of his ideas were developed by the Hargreaves brothers and Patents were filed in 1898. However, the process was not adopted extensively until a few years ago, when foundrymen in England and Germany started to take further interest in its possibilities.

Mr. Kirkham went on to say that stoving capacity was a deciding factor when considering whether to use CO_2 or not, as CO_2 practice saved 50 per cent. of the stoving requirements. There were then no open fires, thus eliminating sulphur fumes from the foundry atmosphere. He illustrated, by slides, many castings which he had made using the CO_2 Process (including intricate pump-bodies using the core-assembly method of moulding) and gave details of the sand mixtures which he used. He claimed, that by using CO_2 his costs were lower, the turnover was increased, savings were effected in the number of box-parts and core-irons required, lifting was reduced, and he could make castings to a much closer tolerance dimensionally. At the conclusion of his talk, the chairman thanked Mr. Kirkham personally, and called upon Mr. H. Broadbent to propose a vote of thanks, which was seconded by Mr. Cook (junior).

Discussion

MR. J. R. PLATT said his great-uncle had been a pioneer of using the CO_2 Process for foundrywork and he was sure that Polson and the Hargreaves brothers would have been delighted to be present that night. He thought that the limited nature of supplies of liquid CO_2 which were available in the early days of the process, was responsible for its slow rate of development.

He asked Mr. Kirkham about means for the re-use of CO_2 sand—he had tried crushing it with a hammer, and sending it through a mill (which was difficult). However, 50 per cent. of the knocked-out sand could be added to new sand for re-use.

MR. KIRKHAM, in reply, said he could not see how to break down used sand except by using a stonebreaker type of machine. He personally did not advocate the use of more than 10 per cent. of used sand.

MR. JONES asked if CO_2 sand could be used to make small gunmetal valves, and serve to retain pressure-tightness.

MR. KIRKHAM in reply said that with ½-in. bore castings made in CO_2 sand, he had less difficulty than when using oil-sand cores. Using semi-skilled labour, he got better surface-finish, due to the employment of fine-grained sand, and difficulties in drying non-symmetrical oil-sand cores were eliminated.

SEVERAL MEMBERS asked questions about the correct gassing techniques to be used for CO_2 moulds, and cores, and in reply, the lecturer asked Mr. F. W. Nield to elaborate on these, which he did, illustrating his answers by showing a few slides.

MR. BROADBENT asked if moulds were gassed before the pattern was drawn, and was bentonite invariably used in the sand.

MR. KIRKHAM replied that it depended on the job, but whenever possible moulds were gassed before removing the patterns, and bentonite *was* always used.

MR. E. BEECH asked what kind of blacking was selected.

MR. KIRKHAM said he used a proprietary brand of blacking for his moulds and cores.

MR. NORTON asked about the danger of "striking-back" from the green-sand backing of CO_2 moulds.

MR. KIRKHAM in reply said there was some danger of this, but CO_2 sand did not readily absorb moisture, and he had successfully used cores when three weeks' old. If there was any doubt, he advocated re-blacking and flame-drying.

MR. W. COLLINGE said that some roller castings he made in CO_2 sand were porous, due, in his opinion, to gas from the CO_2 cores.

MR. KIRKHAM, in reply, said he did not see why a CO_2 core should produce gases any more than oil-sand cores, and inadequate vents were often a cause of this sort of trouble.

MR. G. LAMBERT said he was surprised at the lecturer's remarks about the smell of CO_2 which he thought was odourless.

MR. KIRKHAM replied that a certain amount of smell could be attributed to other constituents used as binders in the green-sand backing.

Breakdown Agents

A MEMBER said that he had successfully used dried sea-sand and coal-dust with CO_2 binders, and asked if bentonite was essential.

MR. KIRKHAM said it was a matter of trial and error, he had produced CO_2-type sand without either coal-dust, or blacking, but now he used only bentonite as a bonding agent. He advised the member to stick to whatever gave him success.

MR. BROADBENT asked about dressings on CO_2 cores, stating that his firm had had, on one occasion, a minor explosion.

MR. KIRKHAM replied, saying that mould cavities required well drying by torch, and at his foundry cores were usually dried in the morning for use in the afternoon, so as to allow adequate time for gases to escape.

THE CHAIRMAN, summing up the discussion, said he was indebted to Mr. Platt for his remarks on historical aspects, and gave the opinion that shop-floor control was of the utmost importance in applying CO_2 practice.

East Anglia

Although snow and ice did not prevent Mr. C. W. Hicks, of Rolls-Royce, Limited, Derby, from coming to Ipswich to talk to the East Anglian section, it did prevent some members from attending the meeting on January 21 and thus only 20 were present to hear Mr. Hicks' paper on the "Manufacture of Aircraft-engine Castings." The fact that the paper had already been presented to the East Midlands branch, and previously published, in no way detracted from the presentation by Mr. Hicks, who amplified many points and showed a number of illustrations which were not in the original version.

In introducing the speaker, the section president, Mr. Berry, said that it was a practical paper, given by a practical man who had personal experience of all the subject covered. To an audience whose everyday foundrywork was concerned with castings of a very different character from those described, it was a tonic to learn of the experiences, problems and techniques in the specialist field. The feelings of all were expressed

FIG. 1.—*The photograph shows, from left to right, the Lord Mayor of Bradford, Mr. H. Forrest, branch president, the Lady Mayoress, and Mr. H. Blakiston, IBF national president, at the dinner/dance of the West Riding of Yorkshire branch.*

in the vote of thanks proposed by Mr. Cates who said that Mr. Hicks combined the technical and practical aspects to produce a perfect balance. The discussion which followed the paper, illustrated the keen interest of the members, and the manner in which Mr. Hicks answered the questions on widely varied points proved his mastery of his subject.

West Riding of Yorkshire

The annual dinner/dance of the West Riding of Yorkshire branch, held at the Midland Hotel, Bradford, on January 11, was especially significant because it was the first to be held since before the war. The record number of 220 attended, prominent among the guests (Fig. 1) being the Lord Mayor of Bradford, Alderman Dr. David Black, and Mr. J. Blakiston, national president of the Institute, with their ladies. The toasts of "The Queen" and "Our Guests" were proposed by Mr. H. Forrest, the branch president, and the Lord Mayor replied for the guests. Mrs. Forrest received a presentation made, on behalf of the branch Council and members, by Mr. J. Blakiston.

It was an outstandingly successful evening, and the branch has already decided to repeat the function at the same place next year.

Tees-side Apprentice Competition

The fifth annual competition for foundry trainees and apprentices will shortly be held in the Tees-side area, and the number of entries received has again broken all records. This competition was instituted in 1954 with the object of stimulating interest by foundry apprentices in practice and technology and judging by the results in past years, and the response in the present competition, the object has certainly been achieved. The competitors are organized in six sections namely: wood patternmaking, steel-moulding, iron moulding, non-ferrous moulding, metal patternmaking, and for a written paper.

In 1954, there was a total of 119 entries which has steadily increased to the present total of 194. The entries in each section this year having exceeded the previous record number.

The organizing committee would like to thank the managements of the firms from which competitors are drawn for the lively interest shown in these events, and the support which they give to their young men. "Judgment day" will be on March 19, at Darlington, and final instructions will be issued to the competitors very shortly. The organizers look to the boys with confidence to raise still higher the standard of foundry workmanship on Tees-side.

Sheffield

The annual dinner of the Sheffield branch was held at the Royal Victoria Hotel, on January 27. Among the guests were the Lord Mayor of Sheffield, Alderman A. Ballard; the Lord Bishop of Sheffield, the Rt. Rev. L. S. Hunter; the Master Cutler, Sir Frederick Pickworth; Mr. W. J. Taylor, Parliamentary Secretary to the Minister of Supply; Mr. J. Blakiston, national president; Mr. R. C. Baker; Mr. E. D. Bool; Sir Robert Boothby; Mr. P. J. Bovill; Mr. David Brown; Mr. H. Bull; Mr. Desmond Donnelly; Mr. V. C. Faulkner; Mr. M. A. Fiennes; Mr. Ambrose Firth; Mr. D. J. Haggie; Mr. M. M. Hallett; Mr. P. B. Higgins; Mr. H. Humphries; Mr. F. A. Hurst; Mr. A. Jollie; Mr. G. Lambert; Mr. S. W. Martin; Mr. W. D. Pugh; Mr. H. W. Secker; and Mr. C. H. T. Williams.

Following the "Loyal Toast," the toast to the "Foundry Industries of Sheffield and District" was proposed by Mr. W. J. Taylor and replied to by Sir Frederick Pickworth. Mr. F. Cousans, senior vice-president of the branch, proposed the toast to "The Guests" and Sir Robert Boothby responded. Music was provided by Hal Baker.

British Standards Institution

New standard for Wire Brushes (*B.S.* 2939:1958) The subject of a new British Standard B.S. 2939:1958 is hand and rotary brushes including wire-scratch, casting, and platers' brushes, scrubs, brooms, rotary cup brushes, and with a wide range of types for the removal of carbon, scale, paint, etc., from metal surfaces (when mounted on portable pneumatic or electric tools and on stationary grinders).

Many of these brushes were originally dealt with in War Office Specification No. TG. 26 and while the British Standard may thus be regarded as superseding TG. 26 it includes, at the request of the manufacturers, many brushes not previously standardized. With certain limitations, the committee has framed the requirements in terms which will include hand-drawn and machine-made brushes, in order that the standard can be applicable to the whole output of the wire-brush industry. The specifications are likely to prove helpful to purchasing authorities and will enable manufacturers to simplify their production.

The standard is available from the British Standards Institution, British Standards House, 2, Park Street, London, W.1, price 7s. 6d.

Foreign Economic Reports

The following extracts have been prepared from recent economic reports emanating from the Export Services Branch of the Board of Trade. In each case an attempt is made to include mention of trends which may influence foundry business.

Philippines: Considerable speculation continued about the Cuaderno Plan pending the return of its author, the Governor of the Central Bank, from his visit to Washington. It was rumoured that the existing system of exchange and import controls would be gradually replaced by other, more effective controls. A member of the Monetary Board who also returned recently from Washington and a tour of Europe, advocated the adoption of the British system of controls and the establishment of a Board of Trade. The Philippine Brass & Copper Company, Inc., 1729, Aviles Street, Manila, has been formed with an authorized capital of P7 million, to manufacture, process and distribute brass and copper and all kinds of non-ferrous products. Pan Asian Steel & Iron Mills, Inc., 502-506, Samanillo Building, has been formed with an authorized capital of P1 million to engage in mining iron ore and the manufacture of steel. Apayao Consolidated Mining Corporation, Republic Supermarket Building, Rizal Avenue, Manila has been formed, with an authorized capital of approximately £900,000 to mine, mill, concentrate, convert, smelt and refine copper. The President has directed a committee to prepare amendments in the law governing mining development in order to render more attractive to foreign investors the terms under which the valuable Surigao nickel deposits may be exploited. In the public bidding held on October 31 no tenders were received by the Government.

Italy: The economic situation remained generally satisfactory. Industrial production in November was over 8 per cent. higher than at the same period last year and, during the month of October, production of steel reached a new high level. The cost of living has remained stable. One of the most noticeable features was the continuing drop in unemployment figures which at the end of August, totalled less than 1,600,000 for the first time since the war.

A new basis for the calculation of the index on industrial production, whereby 1953=100, has been introduced. Under this new system the index of production in September was 144 or 24.1 per cent. above the August index and 7.5 per cent. above September 1956. The average index for the first nine months of the year was 136 or 8.8 per cent. above last year's average. Production of steel in October reached the record total of 615,000 tons, bringing the total production for the first ten months of the year to 5,625,000 tons. Equivalent figures for production of pig-iron were 165,000 tons and 1,745,000 tons.

Austria: A new blast-furnace plant with two furnaces is to be erected on the bank of the river Danube at Ybbs in Lower Austria by the Schmidtstahl Werke, Vienna. Construction is scheduled to begin in the near future and the furnaces are to be installed in the course of 1958. The site chosen has good transport facilities by rail, road and Danube steamer. The fifth blast-furnace of the Vereinigte Oesterreichische Eisen-und Stahlwerke A.G. (VOEST) at Linz has been put into operation. It is reported that the Czech steel industry has ordered a complete cold rolling mill from VOEST to be built and assembled in two years.

Imports increased more than exports; this rise was spread over most of the main items, and in particular motor vehicles, and industrial and electrical machinery. On the other hand, imports of rubber, scrap iron and steel, non-ferrous base metal ores and coal decreased.

Australia: During 1957, the Australian economy has gained considerably in stability and strength, although employment in manufacture has not maintained the rate of increase of earlier years. In spite of a fairly constant level of employment, industrial output has increased somewhat as a result of greater efficiency, export earnings have continued to improve and international reserves have been built up to a high level. The immigration programme has been maintained and the over-full employment position has eased. Industrial disputes were relatively few and limited in scope. There are, however, some anxieties at present. Demand has slackened considerably recently, some local unemployment has developed and some individual manufacturers may experience increasing difficulties as a result of the easing of import restrictions, especially in the face of any increased flow of imports of low priced goods from overseas, and notably from Japan.

The most remarkable developments in 1957 have been in minerals production. In Queensland, a refinery is being built by Rio Tinto Limited, to treat uranium ore from the Mary Kathleen mine, while Mount Isa promises to become a focal point for mineral production in the north. The company's expansion programme includes a second copper refinery at Townsville, to be linked by a railway to Mount Isa. An outstanding discovery of bauxite in 1956 at Weipa, on the western shores of Cape York Peninsula, estimated to contain 400 million tons, is to be developed jointly by Consolidated Zinc Pty., Limited, and British Aluminium Company, Limited, while a second area, also in the north of Queensland, is being explored by a subsidiary of Alcan of Canada. This may lead to the erection of an aluminium plant in this desolate area, provided the formidable problems connected with the building of harbour installations, the production of power and the construction of the treatment plant can be overcome. Steel production has increased with the introduction of new capacity and there has been a greater output of rolled and extracted aluminium products. The output of castings for motor vehicles, internal combustion engines and builders' hardware has improved. Some expansion of investment is being undertaken in the manufacture of internal combustion engines, electric transformers, electric wires and cables, construction and excavating equipment, and hand tools. Elsewhere, additional investment has been largely restricted in 1957 to the iron and steel, non-ferrous metals, cement, pulp and paper, fertilizers and other chemical industries, and to motor vehicle, pharmaceutical and construction equipment production.

Turkey: The contract with Krupp for the construction of a third blast furnace at Karabuk steelworks has been cancelled. The job will now be carried out be another West German firm, Salzgitter Industrialban G.m.b.h. The delivery period is given as 21 months.

Norway: The report of the committee, appointed three years ago by the Nordic Council to investigate ways and means of extending Nordic economic co-operation, was published on October 21. The committee unanimously recommended the establishment of a Nordic Common Market to cover 80 per cent. of inter-Nordic trade and, *inter alia*, the founding of a Nordic investment bank. Norway's visible trading deficit (excluding ships) for the first nine months of the year was some £6,500,000 or 9 per cent. higher than in 1956. The plans for the extension of the State-owned Aardal & Sunndal aluminium works have been adopted. When the extension has been completed in 1965, the total annual production will be about 150,000 tons.

News from South Africa

British Loading Cranes.—An order worth £250,000 has been secured by the British firm of Cowan Sheldon and Company, Limited, of Carlisle, for eight high-speed cargo-handling cranes for service in South Africa. The order was secured in the face of keen competition from South Africa and the Continent. Much of the structural work will be fabricated in Cape Town, but all the machinery will be made in Carlisle.

Order for S.A. Firm.—A local firm, Barberton Iron and Steel (Pty.) Limited, has just completed and shipped an order for asbestos processing machinery received from a mining concern in Canada. The firm has already manufactured and installed similar plant in several South African mines, but this was its first order from Canada. The manufacturers have been given to understand that, if the plant is found to be satisfactory, further orders may eventuate.

ISCOR Extensions.—At the annual meeting of Iscor, held in November, it was revealed that during the year the total sales of rolled, drawn and forged steel products was 1,190,877 tons, excluding 15,762 tons used in connection with Iscor's own extensions. The tonnage sold is higher by 52,000 tons (or 4½ per cent.) than the tonnage sold during the previous year. The cost of the capital extensions schemes of £33,000,000, referred to in the statement to shareholders in 1956, has thus been increased, as a result of increases in prices of industrial equipment, by £6,500,000 to £39,500,000. This amount, together with the amount of £13,500,000 to increase output further and the amount of £3,000,000 for sundry items, brings the total cost of all these plans, based on to-day's prices and estimates, to approximately £56,000,000. The chairman, Dr. F. Meyer, in the course of his address, referred to the recovery of scrap metal from slag as follow: "Iscor is associated with an American company, Heckett Engineering Company, Division of Harsco Corporation, in a process for the recovery of scrap metal from slag. This company, which is carrying out a most valuable service in the recovery of scrap metal which would otherwise be lost, now has plants operating on the slag dumps at Iscor Works, Pretoria and Vanderbijlpark and results achieved to date have come well up to expectations, so much so that it has been decided to increase the capacity of the plant at Iscor Works, Pretoria."

James Brown (Durban) *News Letter*—The January, 1958, issue of this publication contains a report that output from the foundry departments has been greatly increased. This increased tonnage output has, to a large extent, been due to a number of contracts awarded to the company by the South African Railways & Harbours for the supply of rail chairs and brake blocks. In the foundry, production of finished castings in grey irons, or in special alloyed irons, now amounts to approximately 500 tons each month. Other factors which have led to increased output are: new equipment for the handling of raw materials, molten metal and finished moulds has been built and installed and the layout of machines in the production foundry section has been re-arranged. The laboratory facilities have been increased and greater use is being made of the CO_2 method of making cores. By the end of 1957 the five-hundredth roller for the sugar milling industry was cast.

Visitors.—A cocktail party arranged by Victor Kent, Limited, was held at the Langham Hotel in October, to enable Mr. M. Froggatt and Mr. J. Carle, managing director and works director respectively of Tilghman's, Limited, Broadheath, Manchester, England, to meet industrialists centred in the Johannesburg area and their wives. Victor Kent, Limited, have acted as agents for Tilghman's, Limited, for a number of years and many shot-blasting plants of Tilghman manufacture have been installed within the Union but this is the first occasion that senior executives of the Tilghman company have visited South Africa. The main purpose of the visit was to meet users of Tilghman's equipment on their home ground and to explore the possibility of increasing business within the Union by expanding their sales and service organization.

Mr. W. Crawshaw, general manager of the Morgan Crucible Company, Limited, crucible division, spent two weeks in Johannesburg in November, carrying out a brief survey of foundries and steelworks in the Southern Transvaal and planning future sales with Mr. A. W. Linnell, manager of the crucible department of B. Owen Jones, Limited, the South African representatives of Morgan's crucible division. This was Mr. Crawshaw's first visit to the country and he expressed surprise at South Africa's industrial development.

New Patents

(Copies of complete specifications are obtainable from the Patent Office, Sales Branch, 25, Southampton Buildings, Chancery Lane, London, W.C.2, price 3s. 6d.)

785,291. Power Jets (Research and Development), Limited, 25, Green Street, London, W.1.

An improved process for the moulding or casting of profiled articles of smoothly-curved or twisted shape such as turbine and dynamic compressor blades. Spaced at intervals are correctly profiled templates. A sheet of pliable material is stretched in contact with the profiled edges of the templates to form the surface of the mould. While the shape remains substantially in the stretched position, the metal is cast against the shape to form the body.

785,319. Sheepbridge Stokes, Limited, Chesterfield, Derby.

The centrifugal casting of pipes or other cylindrical or like hollow bodies. The Patent also refers to a method for forming the internal shape of the pipe.

785,326. Gewerkschaft Reuss, 48, Bredeneyerstrasse, Essen, Germany.

Production of tubes for the pneumatic or hydraulic stowing of bulk materials by centrifugal casting. The object of the invention is to prevent the extreme wear received by the inlet end of the tube. This is achieved by separate construction of the chilled cast-iron lining.

785,336. Vereingite Aluminium-Werke A.G., Am Nordhahnhof, Bonn-on-the-Rhine.

A method of preventing the cracking of continuous castings of aluminium-base alloys which are free from intentional additions of iron and/or nickel.

785,719. F. J. O. Hurum, Dronningensgt, 50, Trondheim, Norway.

A method whereby the silicon content in a metal may be raised while the sulphur or oxygen content is simultaneously lowered without using two different operations (see also Patent No. 764,157), by the addition of ferro-silicon in briquette form.

THE 19,500-TON CUNARD LINER SCYTHIA has arrived at the shipbreaking yard of Thomas W. Ward, Limited, at Inverkeithing. Two sister ships, the Franconia and the Samaria, were recently broken up at the yard.

Contracts Open

The dates given are the latest on which tenders will be accepted. The addresses are those from which forms of tender may be obtained. Details of tenders with the reference ESB can be obtained from the Board of Trade Export Services Branch, Lacon House, Theobalds Road, London, W.C.1 (telephone: CHAncery 4411, ext. 738 or 771), unless otherwise stated.

WIDNES, February 22—Materials required for Highways Department include castings. Documents from F. A. J. Knight, Borough Engineer and Surveyor, Town Hall, Widnes.

BRIERLEY HILL, February 21—Materials required by Urban District Council for the year ending March 31, 1959, include cast-iron manhole covers and gully grates and frames (Ref. No. 6). Documents from Mr. R. H. J. Comber, Engineer and Surveyor, Civic Buildings, Brierley Hill, Staffs.

STAVELEY, February 24—Requirements of Urban District Council include cast-iron manhole covers and frames (Ref. No. 15), and cast-iron gully grates and frames (Ref. No. 16). Documents from the Engineer and Surveyor, Council Offices, Lowgates, Staveley, near Chesterfield.

MAESTEG, February 22—Materials required by Urban District Council for the year commencing April 1 include iron castings (No. 6). Documents from Lewis W. Jones, Engineer and Surveyor, Council Offices, Maesteg, Glam.

SHERBORNE, March 3—Following required by Urban District Council: iron castings (No. 4) and spun-iron pipes (No. 6). Documents from the Engineer and Surveyor, The Manor House, Newland, Sherborne.

BATLEY, February 22—Materials required by Batley Corporation General Works Department include castings (Ref. No. 16). Documents from Borough Engineer, Hanover Street, Batley.

LANCASTER, February 21—Requirements of Corporation's Highways Committee include manhole covers, gully gratings and iron castings, iron water pipes and special castings. Documents from City Engineer, Town Hall, Lancaster.

MAGHERAFELT, Londonderry, February 20.—Providing and laying approximately 7,032 lin. yd. of 8- and 9-in. dia. spun-iron pipes, together with all necessary sluice valves, air valves, fire hydrants, etc. Documents from W. and M. Given, consulting engineers, 1, Waterside, Coleraine, or W. J. McKinney, clerk to Council, Council Offices, Magherafelt. Deposit £3 3s.

DURHAM, February 24—Following for the year commencing April 1, for County Water Board: standard spun-iron socket and spigot pipes with screwed gland joints and bolted gland flexible joints; standard cast-iron special castings; cast-iron surface boxes; 2- to 18-in. cast-iron sluice valves. Documents from Charles Gibson, clerk to the Board, 43, Old Elvet, Durham.

ELLESMERE PORT, CHES., February 17—Requirements include cast-iron manhole covers and frames and gully gratings and frames. Documents from the Borough Engineer and Surveyor, Municipal Offices, Ellesmere Port.

NEATH, GLAM., February 15—Supply of road castings for Town Council. Documents from the Borough Engineer, Gwyn Hall, Neath.

SOUTH SHIELDS, February 20—Supply of cast-iron gullies, manholes, etc., for Town Council. Documents from Town Clerk, Town Hall, South Shields.

BURMA, February 13—Cast-iron pipes and pipe fittings. (ESB/2175/58.)

BURMA, February 14—Cast-iron flushing cisterns. (ESB/2179/58.)

IRAN, March 10—Cast-iron pipes. (ESB/1811/58.)

SOUTH AFRICA, February 14—Cast-iron chairs. (ESB/1449/58.)

ANDERSTON FOUNDRY COMPANY, LIMITED—CIC consent has been obtained to a scrip issue capitalizing £70,000 in the proportion of seven new shares for every 18 held on February 10. The new shares will rank for any final dividend for the year to March 31.

TO ADVISE on the design, manufacture, and supply of all types of heavy steel forgings, castings, vessels, plate, and structures, the Asquith Machine Tool Corporation, Limited, is establishing a new division within its sales organization, Drummond-Asquith (Sales), Limited. The new division will operate from the company's offices in Halifax House, Strand, London, W.C.2. The company announces that Ruhrstahl A.G., Henrichshutte, Hattingen-Ruhr, has entrusted Drummond-Asquith (Sales), Limited, with its sole representation in the UK and Eire.

Company News

BROWN BAYLEY STEELS, LIMITED—The company has declared a second interim dividend of 3 per cent., making 6 per cent. to date in respect of the 15 months ended September 31, 1957. For the year ended September 29, 1956, an interim of 3 per cent. was followed by a final of 6 per cent. It is intended to pay a final dividend for the 1956-57 period next May.

BROOM & WADE, LIMITED, makers of air compressors, pneumatic tools, etc., of High Wycombe (Bucks)—The achievement, despite adverse factors, of the substantial, although lower, profits of the year ended September 30, 1957, makes the year in some ways the most successful in the company's history. Turnover was practically maintained and the order-book is in a healthy state. With the unchanged 12½ per cent. dividend, group profits, before tax, were £566,046 (£623,658).

COVENTRY GAUGE & TOOL COMPANY, LIMITED—The credit squeeze and other financial measures have made orders more difficult to get and many customers are deferring decisions on outstanding business, but, states the chairman, Mr. S. J. Harley, the company need not be unduly pessimistic about the future. Group net profits for the year ended August 31, declined to £134,364 (£162,027), after depreciation of £72,501 (£67,307) and tax of £207,108 (£194,529). The ordinary tax free dividend is held at 6¼ per cent.

E. SHIPTON & COMPANY (HOLDINGS), LIMITED, electrical and mechanical engineers, of Northwood Hills (Middx)—No interim dividend will be paid for the year to March 31, 1958. The dividend total for 1956-57 was 25 per cent., including 10 per cent. interim. The directors explain that current market conditions have prevented the full redeployment of the capital consideration from the sale of a part of the business. Dividend policy will be determined only after the year's trading results are available, they add. The board intends to expedite accounts so as to have full results available before the end of July.

Recent Wills

MILLICAN, F. G., a principal of Flannery, Baggallay & Johnson, Limited, consulting engineers, of London, E.C.3 ... ... £3,849

DALE, STANLEY, a partner in J. W. Dale & Son, consulting marine engineers and ship surveyors, of North Shields £25,678

WILD, L. L., a director of W. J. Wild, Limited, manufacturers of steel and metal pressings, etc., of Birmingham £27,122

MACMILLAN, H. M., founder, chairman, and managing director of the Blythswood Shipbuilding Company, Limited, Scotstoun, Glasgow ... £320,956

GRESTY, COLIN, a director of the North Eastern Marine Engineering Company, Limited, Wallsend, and a past president of the Institute of British Foundrymen and the National Ironfounding Employers' Federation £10,640

BAILEY, DR. R. W., formerly consulting research engineer of the Metropolitan-Vickers Electrical Company, Limited, president of the Institution of Mechanical Engineers, 1954-55 ... ... £5,746

RAMSDEN, BRIG. SIR A. M., solicitor, of Leeds, a director of the David Brown Corporation, Limited, David Brown (Holdings), Limited, and Hopkinsons, Limited, engineers, etc., of Huddersfield ... £9,943

CANTRILL, HARRY, former chief quality engineer at the Derby works of Rolls-Royce, Limited, who was responsible for the "Eagle," one of the most powerful piston engines ever produced in England £3,296

HINGLEY, H. B., chairman of Harts Hill Iron Company, Limited, Brierley Hill (Staffs), and John Bradley & Company (Stourbridge), Limited, iron and steel makers, a director of N. Hingley & Sons, Limited, cable and chainmakers, etc., of Dudley (Worcs), president of the Birmingham Iron and Steel Exchange, 1932-39 ... ... £63,158

News in Brief

EIGHT HUNDRED PEOPLE attended the annual dance of the Atlas and Norfolk Sports Club (which is for employees of Thos. Firth & John Brown, Limited, Sheffield), at the Cutlers' Hall, Sheffield, on January 29.

NEW METALS & CHEMICALS, LIMITED, and Fleischmann (London) Limited, announce their removal to larger premises at: Chancery House, Chancery Lane, London, W.C.2. Their telephone numbers have been changed to HOLborn 7415 (8 lines) whilst their teleprinter and telegraphic address remain as before.

CROMPTON PARKINSON, LIMITED, has secured an order from the United States for six power transformers worth more than $200,000. The transformers, which will be used on the Fremont Canyon power project in Wyoming, will be built at the company's Hayes (Middx) transformer works during the next 16 months.

THE 50,000TH FORD "POPULAR" to be produced at the Doncaster works of Briggs Motor Bodies, Limited, in the last two years, was driven out by the Mayor of Doncaster, Councillor W. Chappell, on January 30. It was stated that the company is to spend £60,000 on re-equipping and re-tooling at the works for the production of vans.

SALES AND EARNINGS of the U.S. Steel Corporation for 1957 set up new records. Net income of $419,000,000 is equal to $7.33 per common share, against the 1956 net of $348,000,000, equal to $6.01 per share. The usual quarterly dividend of 75 cents a share is payable on March 10 to shareholders registered February 7.

THE SHARE CAPITAL of High Precision Equipment, Limited, Bletchley (Bucks), has been purchased for £106,800 cash by Associated Engineering Holdings, Limited, which intends to carry on and expand that business under the present management and staff. High Precision Equipment specializes in the design and manufacture of special machine tools.

SIMON HANDLING ENGINEERS, LIMITED, Stockport (Ches), has secured an order worth more than $1,000,000 for eight large pneumatic suction plants, through its Canadian company, Simon Engineering Companies of Canada, Limited. Six of the suction plants are for Montreal harbour and two are for Quebec. They will be used for handling grain.

THE FIRST of a fleet of 300 buses and coaches are now being placed in service by the Netherlands Railways. They are of an integral design employing Dutch-built bodies and underframes to ensure a high content of local labour. All the mechanical components, which generally follow the layout of the Leyland "Worldmaster" chassis, are being suppled by Leyland Motors, Limited, Lancashire.

A CAR made in Coventry in 1906 and claimed to be the oldest Standard car in existence, was recently discovered on an Australian tobacco farm. It has now been restored in Standard's Australian factory at Port Melbourne and bought by Mr. R. B. Morrow an executive of the company. The car which was exported to Australia in 1907, is an open tourer with a six-cylinder engine, the cylinders being cast in pairs.

LITHGOWS, LIMITED, Glasgow, has received orders for two further ships of about 10,200 tons d.w. from the British & Burmese Steam Navigation Company, Limited, which is managed by P. Henderson & Company, Limited, Glasgow. The two new vessels, which will be somewhat larger than the three already on order, will be fitted with diesel machinery by John G. Kincaid & Company, Limited, Greenock.

LANE & GIRVAN, LIMITED, Bonnybridge (Stirlingshire), has received two orders for a total of 100 wood-burning stoves, from the island of St. Helena. The company, which has been exporting stoves to St. Helena for many years, has also received orders from places as widely scattered as Fiji, Peru, British Honduras, Christmas Island, Irak, Iceland, and Nieu Island, about 500 miles east of Tonga in the Pacific.

MATTHEW HALL & COMPANY, LIMITED, London, N.W.1, has been awarded a contract worth approximately £1,000,000 for the design, procurement, construction, and commissioning of a new chemicals building at the Warrington factory of Joseph Crosfield & Sons, Limited. This contract is the first stage in the Warrington company's eight-year programme to rebuild its works at a cost of about £5,000,000. It is a Unilever subsidiary, one of the major productions being sodium silicate.

A LICENCE for the construction of its ship diesel engine has been granted by the Royal Machine Factory Stork Bros. & Company, of Hengelo, Holland, to Hawthorn, Leslie (Engineers), Limited, Newcastle-upon-Tyne. This is the third British concern to acquire a licence, the two others being the Fairfield Shipbuilding & Engineering Company, Limited, Govan, Glasgow, and the Wallsend Slipway & Engineering Company, Limited.

FOUR EMPLOYEES who have been with the North British Steel Foundry, Limited, Bathgate, since it was founded 50 years ago have been presented with inscribed silver salvers. They are Mr. H. Kerr, foreman moulder, Mr. A. Galloway, moulder, Mr. H. Stein, engineer, and Mr. H. Forrest, foreman engineer. Mr. G. Macbeth Menzies, managing director, made the presentations. His father started the firm in 1907 with about 30 employees. The foundry now has 700 on the payroll.

WORK WAS RESUMED on January 23 by some 500 men at the Nuneaton factory of Sterling Metals, Limited. Three fettlers had been dismissed and a sit-down strike was staged by other men when two moulders were alleged to have "blacklegged" by volunteering to work in the fettling shop while the fettlers were dismissed. The 31 fettlers accepted a re-engagement offer made on condition that they agreed to piece-work rates and dealt with grievances through established machinery.

WALLACE & LONGDEN, LIMITED, Long Eaton, are building a "go-through" Leavers-lace-making machine at a cost of over £10,000 in the factory of R. Granger & Sons, lace manufacturers, Long Eaton. The machine, which occupies 450 sq. ft. ground, weighs over ten tons, and is 45-ft. long, 12-ft. wide, and 12-ft. high. Similar machines built by the firm since 1888 have been exported to North America, Brazil, Mexico, Germany, France and Italy. It is the first to be constructed in Long Eaton since the war.

A PIECE OF COPPER GAS-PIPE found in the Mayor's safe at Wednesbury has been identified as the oldest extant relic of the gas industry. The Mayor, Councillor Walter Morgan, has presented it to Mr. F. H. Bate, Wolverhampton Divisional Engineer of the West Midlands Gas Board, for permanent loan to the gas section of the Science Museum, South Kensington. The copper piping came from the house at Handsworth, Birmingham where William Murdoch, of Soho Foundry fame and the father of the gas industry, lived.

TEAMS FROM SHEFFIELD WORKS will be taking part next autumn and winter in a circuit scheme of visits organized by the Sheffield and Rotherham Productivity

Committee of the British Productivity Council. It is hoped to promote a freer exchange of ideas and methods between firms. Specific points to be studied this year will include handling and packaging, education and training, and production control. Manufacturing processes are not included as some firms felt in an initial scheme last year that competitors might benefit from secrets of the firms they visited. The teams usually number from three to six, and are often representative of management, technicians and shop-floor personnel.

AT THE ANNUAL MEETING in Birmingham, on January 28, of the British Cycle and Motor Cycle Industries Association it was stated that production of motor cycles in Britain reached a record level of almost 158,000 last year but while sales on the home market showed a marked increase there was a drop in export earnings from £9,100,000 to £8,000,000. The decrease in export earnings of cycles and tricycles was even sharper, from £29,600,000 to £23,800,000. Mr. T. J. Bouldstridge, president of the Association and managing director of the British Cycle Corporation, Smethwick, said that there were, however, signs of an upward swing in the exports of both cycles and motor cycles and the industries were hoping for improvements in 1958.

Mr. MICHAEL HOPE, chairman and managing director of Henry Hope & Sons, Limited, presented awards to apprentices of Birmid Industries at Smethwick on January 29. Certificates were presented to 21 apprentices. The Birmid group has announced its intention of increasing its annual apprentice intake by between 15 and 20 per cent. Welcoming this decision Mr. Hope said that "at times like these, when people are talking about redundancy and short-time working and recession in trade, it is a good thing to see firms planning to expand rather than contract." The Birmid apprenticeship scheme aims to provide qualified men in the crafts, trades and technical posts of the foundry and metal industries. It was stated that there is a waiting list for the vacancies.

COVENTRY CITY COUNCIL has been asked by the solicitors of Sterling Metals, Limited, one of the Birmid Industries group, if it is interested in acquiring the company's factories at Coventry and the land which is zoned, in the city's development plan, as an open space. It is probable, it is stated, that during the next three years the company will concentrate all its activities at Nuneaton and sever connection with Coventry where Sterling Metals was founded in 1907. The company has two factories in Coventry, one at Northey Road employing about 500 operatives and the other at Durbar Avenue employing 300. It is thought that the Northey Road factory will be closed and its work transferred to Nuneaton during this year and that the Durbar Avenue plant will be vacated within three years. The Nuneaton factory employs about 1,650.

Mr. W. B. HENDRY of the National Foundry College, Wolverhampton, is to be one of the lecturers at a series of courses on "Adjustment to Industry" which the Staffordshire Association of Boys Clubs is organizing at Nash Court near Ludlow. The first of the courses began on February 3 and apprentices attending were from Midland firms including John Thompson (Wolverhampton) Limited, Rubery Owen & Company, Limited, John Harper & Company, Limited, Wolverhampton Die Casting Company, Limited, Chubb Lock and Safe Company, Limited, Garringtons, Limited, Charles Richards & Sons, Limited, Goodyear Tyre and Rubber Company, Limited, Smith & Davis, Limited and Bloxwith Lock and Stamping Company, Limited. Many of these companies are also providing visiting lecturers for the courses which will last a week.

ECSC Steel Output for 1957

Steel output in the European Coal and Steel Community last year reached an all-time record. Provisional figures published by the statistics division of the High Authority show that it reached 59,764,000 metric tons, compared with 56,800,000 tons in 1956, and 41,816,000 tons in 1952, the year before the Common Market started. The 1957 figures represent increases of 5.2 per cent. and 42.6 per cent., respectively, over 1956 and 1952. The greatest percentage increases in 1957 occurred in Italy (14.5 per cent.) and the Netherlands (12.5 per cent.), while the greatest increase by volume was in Germany (1,318,000 tons, or 5.7 per cent.).

Community steel output in December reached 4,994,000 metric tons, compared with 5,192,000 tons in November, and 4,734,000 tons in December, 1956.

Output of pig-iron and ferro-alloys in the community in 1957 was also higher than ever before, rising by 3.6 per cent. to 45,123,000 metric tons, from 43,547,000 tons in 1956. December output amounted to 3,847,000 tons, against 3,883,000 tons in November, and 3,678,000 tons in December, 1956.

Crude Steel (Metric Tons)

	December, 1957.	January–December, 1957.	January–December, 1956.
Germany	1,987,000	24,507,000	23,189,000
Saar	279,000	3,459,000	3,375,000
Belgium	537,000	6,259,000	6,676,000
France	1,266,000	14,096,000	13,442,000
Italy	558,000	6,768,000	5,911,000
Luxembourg	273,000	3,493,000	3,456,000
Netherlands	94,000	1,182,000	1,051,000
TOTAL	4,994,000	59,764,000	56,800,000

Pig-iron and Ferro-alloys (Metric Tons)

	December, 1957.	January–December, 1957.	January–December, 1956.
Germany	1,547,000	18,358,000	17,577,000
Saar	260,000	3,127,000	3,018,000
Belgium	486,000	5,550,000	5,658,000
France	1,050,000	11,917,000	11,423,000
Italy	167,000	2,137,000	1,935,000
Luxembourg	274,000	3,332,000	3,272,000
Netherlands	63,000	702,000	664,000
TOTAL	3,847,000	45,123,000	43,547,000

Rating Assessment Confirmed

An assessment of £92 made on a canteen and garage belonging to the West Bromwich firm of ironfounders, W. & J. Lawley, Limited, of Sams Lane, has been confirmed by the Stafford South Local Valuation Panel.

On behalf of the company it was said that the property, on the opposite side of the road to that of the company, consisted of a timber building used as a canteen with an adjoining brick-built kitchen. The garage buildings which in turn adjoined the kitchen, were of timber—they were in fact "tumble-down farm buildings many years old." Some 60 people used the canteen everyday. It was said that it was required by law that there should be a canteen for the factory. The canteen was run at a loss. Mr. F. J. Shuttleworth, representing the local Valuation Officer, stated that the garage and canteen had been regarded as separate hereditaments as they were on the opposite side of the road to the factory.

Personal

Mr. A. J. BEANLAND B.SC.TECH., has been appointed a director of Lancashire Dynamo Group Sales, Limited, and will be in charge of the L.D. Group Sales organization at home and overseas.

Mr. HAROLD MOSS, senior representative for the London and Southern counties for English Tools, Limited, Clarington Forge, Wigan, Lancashire, has been presented with a gold watch on completing 50 years with the company.

British Road Services announce that Mr. F. R. REEVES, traffic superintendent (operating), London district office, South Eastern Division, has been appointed district manager, East Anglia district, South Eastern Division.

Mr. DAVID H. BRAMLEY, head of the Department of Industrial Administration at the College of Technology, Birmingham, has joined the board of Geo. Salter & Company, Limited, West Bromwich. He will continue to hold his College post.

Mr. W. CARTER has been appointed a director of Albright & Wilson, Limited. He joined the company in 1940 and was appointed the first managing director of the operating company, Albright & Wilson (Mfg.), Limited, on its formation last year.

Mr. F. BARRINGTON HOOPER, joint managing director and commercial director of Industrial Newspapers, Limited, publishers of FOUNDRY TRADE JOURNAL, has been appointed a director of Argus Press, Limited, with which Industrial Newspapers is associated.

To mark her family's 224 years' service with Qualcast, Limited, Derby, Mrs. MARY AMATT, a canteen worker, has received 224 Premium Bonds from the firm. Her grandfather, grandmother, father, mother and two sisters have all worked for the company.

Mr. KENNETH DOUGLAS, general manager since 1954 of William Gray & Company, Limited, the West Hartlepool shipbuilders, has been appointed assistant to the managing director and shipyard controller of Austin & Pickersgill, Limited, Sunderland.

Mr. H. BRONNIMAN has resigned his position as general works manager with Lake & Elliot, Limited, steelfounders and engineers, of Braintree, Essex, and will be joining Acrow (Engineers), Limited, as works director, in charge of their main factory in Saffron Walden.

Major-General E. P. READMAN, a director of English Steel Corporation, Limited, sailed for Africa on January 30. He is on a two-months' tour of customers and agents in centres in South Africa and Rhodesia, and will see the new steel centre at Vereeniging, near Johannesburg.

After three years as head of the Chemistry Department of the Birmingham College of Technology, Dr. G. TOLLEY will leave at the end of March to become director of research of Allied Ironfounders, Limited. Dr. Tolley has been with the Department seven years, and was formerly senior lecturer there.

Mr. B. A. HENSLER has been appointed to the board of directors of Siemens Edison Swan, Limited. Mr. Hensler, who is managing director of Siemens Edison Swan (Export), Limited, is also on the boards of the company's overseas subsidiaries, and that of Associated Electrical Industries (Overseas), Limited.

Mr. J. H. D. PRICE, 35-year-old sales manager of Pollard Bearings, Limited, Ferrybridge, near Knottingley, is flying by way of New York on a 15,000 mile sales tour. The headquarters for his intensive travel programme will be the firm's new factory at Oakville, Toronto. This is Mr. Price's fourth Atlantic crossing in 12 months.

Mr. L. E. NICHOLS has resigned his post as area engineer of the National Industrial Fuel Efficiency Service in the North East, and is to re-enter consulting engineering practice. Mr. GEORGE GILL, area engineer in the North West, will temporarily exercise general supervision over the Leeds, Sheffield and Newcastle offices also.

Mr. E. B. BULL, works manager of Wardsend Steel Company, Limited, has been appointed a director of the company. Mr. G. H. BLAKELEY, works manager of Andrews Toledo, Limited, and Andrews Toledo (Wire Rod), Limited, has been appointed a director of the latter firm. The firms are members of Darwins Limited, group, Sheffield.

Mr. DENNIS REVITT of Deacon & Littleford, art metal manufacturers of Lombard Street, Lichfield, was enrolled as a Freeman of the Lichfield Worshipful Company of Smiths, at the Mayoral Court of the Company in the Guildhall, Lichfield, on January 28. Mr. Revitt, who is regarded as a craftsman of outstanding ability with art metal, joined the firm in 1945.

Mr. HERBERT E. REYNOLDS, who has been with Ruston & Hornsby, Limited, the Lincoln engineers, for 30 years, has been appointed manager of the company's Bristol office in succession to Mr. C. W. Hudson, who has retired after 50 years' service. On demobilization from the RAF in 1946, Mr. Reynolds served as technical representative in the London office, and in 1955 he became assistant manager at Bristol.

Reynolds TI Aluminium, Limited, announce the following board appointments:—Sir IVAN A. R. STEDEFORD, K.B.E. (chairman); Mr. R. S. REYNOLDS, JNR. (alternate chairman); the LORD REITH, P.C.; Mr. W. G. REYNOLDS; Mr. J. L. REYNOLDS; Mr. J. H. MCCONNELL; Mr. A. J. S. ASTON, and Mr. R. D. YOUNG. Mr. PAUL R. MCGEHEE has been appointed chief executive (manufacturing and technical) and Mr. BASIL JAMES, chief executive (sales).

Mr. P. H. MUIRHEAD has resigned his appointment as managing director of Vickers-Armstrongs (Engineers) Limited, and his directorship of that company. He will retain his other group directorships for the time being, but remains on sick leave. Mr. W. D. OPHER has been appointed managing director of Vickers-Armstrongs (Engineers) Limited, and a special director of Vickers, Limited. Mr. R. P. H. Yapp has also been appointed a special director of the latter company.

American Foundrymen's Society announce the following nominations for officers for the 1958-59 sessions. As president, Mr. LEWIS H. DURDIN, president, Dixie Bronze Company, Birmingham, Alabama; as vice-president, Mr. CHARLES E. NELSON, technical director, magnesium division, Dow Chemical Company, Midland, Mich.; as directors, Mr. DAVID W. BOYD, Mr. T. W. CURRY, Mr. R. R. DEAS, JR., Mr. JAKE DEE, Mr. WEBB L. KAMMERER, and Mr. H. M. PATTON.

Mr. W. J. W. PROCTOR, sales director of Follsain-Wycliffe Foundries, Limited, will be visiting Johannesburg and district, after which he will make a comprehensive tour of North and South Rhodesia with the object of carrying out a sales survey and in order to appoint agents to handle the firm's heat- and abrasion-resisting castings, and pulverizing mills, and also variable-speed gear-boxes and speed reducers manufactured by their subsidiary company, Varatio-Strateline, Gears Limited. Mr. Proctor will be arriving in Johannesburg at the end of this month.

(*Continued on page* 166)

TWW

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FS/29

Personal

(*Continued from page* 164)

Mr. W. E. WRIGHT, a director of the Pyrene Company, Limited, fire extinguisher manufacturers, of Brentford (Middx), and head of its metal finishing division, has retired. Mr. Wright was largely instrumental in introducing into this country the Bonderizing range of processes for paint bonding and for facilitating the cold working of metals. Some 30 years ago he was connected with the original Parkerizing process. Mr. H. F. PARSHALL, a director of the company since 1947, has succeeded Mr. Wright as the director responsible for the metal finishing division.

Following the acquisition of the Fletcher Miller group by C. C. Wakefield & Company, Limited, the following appointments are announced: Mr. S. R. MILLER, chairman, Fletcher Miller, Limited, has been appointed to the board of C. C. Wakefield & Company, Limited. Mr. A. GEORGE, and Mr. R. T. MILLER, director and secretary, and director, respectively of Fletcher Miller, Limited, become directors of Wakefield-Dick Industrial Oils, Limited, and Mr. J. C. CRAGG, manager, Stanlow Works, C. C. Wakefield & Company, Limited, Mr. J. W. MACMAHON, general manager, industrial lubricants division, Wakefield-Dick Industrial Oils, Limited, and Mr. L. J. WENDRIDGE, secretary of the latter company, have been appointed to the board of Fletcher Miller, Limited.

Obituary

SIR HOLLAND GODDARD

Sir Holland Goddard, president of Wadkin, Limited, woodworking machinery and machine-tool engineers, of Leicester, died suddenly in London on January 30; it was his 75th birthday. On leaving school he joined the family business of Wadkin & Company and became its sole proprietor on the death of his father in 1927. The business was converted to a private limited company in 1936 and became a public company in 1951. Sir Holland resigned his executive offices of chairman and director of Wadkin's when he became president in 1956. He was until recently chairman of the National Steel Foundry (1914), Limited, Leven, and of the Imperial Typewriter Company, Limited, Leicester. He was also a member of the Machine Tool Advisory Council, the Grand Council of the Federation of British Industries, and a number of other national and local bodies. Sir Holland received his knighthood in 1949 whilst president of the Machine Tool Trades Association, with which he had been connected since 1949.

The death occurred recently of Mr. GILBERT COOPER, a retired commercial manager of Richard Thomas & Baldwins, Limited.

Mr. R. C. MOLINEAUX, governing director of Wm. Molineaux & Son, Limited, steel merchants of Smethwick and of the Soho Tinning Company, Limited, died on January 25 at the age of 64

The death is announced of Mr. D. K. BARCLAY, chief metallurgist, Head Wrightson & Company, Limited. It was in 1918 that he joined the firm, when the steel foundry was launched. In the early stages, he helped with the pioneering and since that time has been responsible for much of the scientific development of plant and process. He was president of the Middlesbrough branch (now the Tees-side branch) of the Institute of British Foundrymen in 1939-40.

Forthcoming Events

FEBRUARY 10

Institute of Metals

Scottish local section:—"Recent Developments in the Foundry," by D. V. Atterton, M.A., Ph.D., 6.30 p.m., at the Institution of Engineers and Shipbuilders in Scotland, 39, Elmbank Crescent, Glasgow.

Institution of Works Managers

Manchester branch:—"Supply and Use of Scientists in Industry," by F. Morton, Ph.D., 6.45 p.m., at the Grand Hotel.

FEBRUARY 11

Institute of British Foundrymen

Coventry and district section:—"Internal Stresses in Castings," by M. M. Hallett, M.Sc., F.I.M., 7.30 p.m., at the Coventry Technical College, Room. A.5.

Slough section:—"Feeding Aids to Castings," by A. L. Logan, 7.30 p.m., at the Lecture Theatre, High Duty Alloys, Limited.

Incorporated Plant Engineers

Manchester branch:—"Modern Trends of Lighting in Industry," by A. Wilcock, 7.15 p.m., at the Engineers' Club, Albert Square.

Institution of Production Engineers

Birmingham graduate section:—"Metal Spraying," by W. E. Stanton, 7 p.m., at the James Watt Memorial Institute, Great Charles Street.

FEBRUARY 12

Manchester Metallurgical Society

"Plastics *versus* Metals," by J. M. J. Estevez, B.Sc., 6.30 p.m., in the Manchester Room of the Central Library.

Institute of British Foundrymen

West Riding of Yorkshire branch:—"Properties of Castings in Copper-base Alloys," by F. Hudson, 7.30 p.m., at the Bradford Institute of Technology.

Incorporated Plant Engineers

Western Branch:—"Oil Firing," by Dr. G. J. Gollin, M.A. (Cantab), 7.15 p.m., at the Grand Hotel, Bristol.

FEBRUARY 13

Liverpool Metallurgical Society

"Wear in Cast Iron," by H. T. Angus, M.Sc., Ph.D., 7 p.m., at the Liverpool Engineering Society, 9, The Temple, Dale Street.

Institute of British Foundrymen

Lincolnshire branch:—"Sand Castles," by D. Killingworth, 7.15 p.m., at the Technical College, Lincoln.

FEBRUARY 14

Manchester Association of Engineers

"Models in Engineering," by Professor J. A. L. Mathieson, M.B.E., M.S.C., Ph.D., 5.45 p.m., at the Engineers' Club, Albert Square.

Diesel-Hydraulic Loco Order

British Railways' workshops at Swindon are to build 30 main-line 2,000 h.p. diesel-hydraulic locomotives for use in the western region. The British Transport Commission announces that they will be in addition to three similar locomotives at present under construction at Swindon. The locomotives form part of the 130 required to replace over 200 steam locomotives in the region. Only 34 now remain to be ordered.

Western region of BR has placed contracts for the locomotive power equipments with Brush Traction, Limited (for the supply of the Maybach diesel engines), J. Stone & Company (Deptford), Limited (for the Mekydro transmissions), and Brown-Boveri (British), Limited (for the supply of the electric control equipments).

Bomber pilot rolls steel plate

—*and finds it not so different!*

Jim McCubbin has a rewarding job—in every sense.
Story by David Murray, writer and T.V. commentator

TEN YEARS AGO Jim McCubbin never imagined that he would ever be one of three Rollers in the big plate mill at Dalzell Steel Works, Motherwell, the most powerful of its kind in all Britain.

His youthful ambition was to be a veterinary surgeon. But the war set him on another course. In 1939, he joined the Royal Air Force as an Aircraftsman (2nd Class). He was soon a Sergeant Pilot, next a Flight Sergeant, and at length a Flight Lieutenant. As a bomber pilot he did two full tours of duty, one with Coastal and the other with Bomber Command. Coming out of the R.A.F. two years after the war, he flew for B.E.A. between Belfast, Glasgow and London for another couple of years. That brought him to 1949, when he thought it was time to start a career with his two feet well on the ground.

HE GOT ON BETTER WITH HIS COAT OFF

The problem for ex-Flight Lieutenant James McCubbin, D.F.C., was what that career ought to be. Like many another young fellow out of the war, he did not fancy going back to his books. Having a good look at the steel trade in his native town it struck him that he need not go any further, and he jumped at the chance of a clerk's job in the Dalzell Steel Works. There he saw that he might make better progress with his jacket off than with it on.

To get among the pounding machinery, he became a stocktaker at the big plate mill. His big chance came when a third shift was manned at the rolls. Getting into real working togs, he took on the job of Breaking Down – rolling the great white hot slabs to the proper width and passing them on to the Roller. In 1953, by which time he had learned a very great deal the hard way, he himself became a Roller, charged with finishing the plates to gauge.

The three Plate Mill Rollers, who work in shift turns, are the key production men at Dalzell; it was rapid promotion for a man who had never set foot in a steel plant until he was close on thirty. But Jim McCubbin had rightly figured that there would be as good chances on the production side, as in the more bookish branches. He has, of course, attended classes and read more than the odd book on steel making. But his main classroom has been the plate mill.

As he says . . . " It's just like flying. You're up against mass power and the forces of nature. Even to stay still, you've got to keep going . . . "

WELL PAID — AND SATISFYING

Off the job, which in view of its responsibility is well paid, even by professional standards, he likes good books and good music. In the summer he golfs. But his chief spare-time hobby is three-year-old, sloe-eyed, dark-haired Patricia Ellis McCubbin. Her middle name comes from grandfather Ben Ellis who played football years ago for Motherwell F.C.

To see Jim McCubbin and his two buddies on the other shifts, Bob Jaffrey and John Lang, putting through the plates, you might think that plate rolling is easy. But hot, plastic steel is what the Scots call " kittle stuff." The job in fact calls for as much stamina, nerve and operative skill as flying a big bomber.

That's why it's well paid. And that's one reason, though not the only one, why ex-Flight Lieutenant James McCubbin, D.F.C., went all out to be a Roller when he saw the chance.

As he says . . . " It feels as good to put in a good shift with no troubles, as to make the target and get back home."

This report was commissioned by the British Iron and Steel Federation, which believes that everyone in Britain should know the facts about Steel, and about the men and organisations that make it.

Raw Material Markets

Iron and Steel

Iron-ore imports in 1957 were over 1,250,000 tons more than in the previous year and deliveries from both home and overseas continue at a sufficiently high level to provide adequate supplies for both consumption and stock. Ample supplies of coke are also coming to hand and producers of pig-iron have at present all the raw materials they need to keep their furnaces working to capacity if the demand warrants it.

Outputs of pig-iron in 1957 from a smaller number of larger-capacity furnaces, provided an increase of over 1,000,000 tons in the previous year's production. Stocks on hand, however, at the end of the year were about 400,000 tons more than at the end of 1956. During recent months many producers have had to stock because of reduced demand from consumers, chief among which are the steelworks. From the 98 furnaces in blast in 1957, 63 were engaged in the production of basic pig-iron, and the deliveries from these furnaces coupled with the appreciable tonnages of imported pig-iron, have provided enough to lead, in some instances, to a curtailment in outputs. It is expected that when present stocks at the steelworks are reduced increased demands will be made on home furnaces for supplies, particularly as imports on the previous scale are not likely to be repeated during the current year.

Producers of high-phosphorus pig-irons also find it increasingly difficult to dispose of their outputs, so that stocks of this grade at the furnaces have also increased. To a lesser extent this also applies to the production of hematite pig-iron. Only in the low-phosphorus grades, used chiefly by the engineering and speciality foundries, are producers able to dispose of their makes. The call from these foundries for high-duty castings is maintained, and good outputs result. The light foundries, however, continue quiet and many of the jobbing and textile foundries are short of work so that demands for the high-phosphorus irons are only moderate. Fortunately, export merchants have been able to relieve the furnaces of some of their excess tonnages for overseas shipment, orders having been secured against strong competition from makers abroad.

Refined irons are plentiful and suppliers could undertake much more business for both home and overseas consumers. Foundry coke deliveries are meeting with requirements, and there appears to be some easing in the supply of some of the Welsh grades. The foundries are well provided with scrap, as well as with ganister, limestone, and firebricks.

The re-rollers producing small bars and light sections continue to be in need of more work to keep their mills going at capacity levels. Many of these mills are engaged on a shortened working week, as orders are scarce and there is little export business due to the wide differential in prices on the Continent. For the larger sizes there is a better demand, and business continues good for reinforcing rods.

Home steelworks are able to meet the needs of the re-rollers for steel semis, and available supplies are larger than current demands. There has, however, been a bigger demand for supplies recently.

Non-ferrous Metals

The launching of the US satellite last weekend raised hopes that its psychological effects would be beneficial to non-ferrous metal markets. In the event, however, the London market, after opening strongly on Monday, sagged in later dealings and markets reverted to their former slow pace.

The feature of the copper market has been the announcement by the Rhodesian Anglo-American group of copper producers of a 10 per cent. cutback in their planned production, which will amount to a total of 27,000 tons. The reduction, however, differs from that of other producers in that it is based on envisaged production for 1958 rather than on existing production. Thus a perusal of the full text shows that the actual copper reductions will only amount to about 3 per cent. if last year's total production of some 220,000 tons is used as the basis.

The crux of the situation is that the Bancroft mine produced only about 13,000-15,000 tons last year, but its planned production in 1958 was at an annual rate of 40,000 tons. Accordingly, Bancroft is to be closed down and an additional output of 13,000 tons is to be allocated to Nchanga and Rhokana—which is given as the discrepancy between Bancroft's actual and potential output during this period.

A balance between production and consumption has now been achieved, it is generally believed, provided that the US Government's absorption of some 9,000 tons a month for the stockpile is taken into consideration. On the other hand, producers continue to hold large stocks, which will continue to influence the behaviour of the market and, in the present circumstances, is likely to remain a bearish factor.

The main essentials of the US copper price structure are unchanged, though subject to considerable pressure. US producers are quoting 25 cents, US customs smelters 24 cents, with scrap on offer at 17½ cents per lb. Some realignment of these prices seems necessary and it is expected that the producers and custom smelters will lower their quotations shortly.

In tin, the International Tin Council communiqué had the immediate effect of firming up the price of three months' metal, as it is now generally believed that the buffer stock pool will have sufficient funds to deal with available tonnages until demand revives. In this connection it is realized that US stocks in the hands of consumers are now low. In the US the price is fluctuating around 93 cents per lb.

Lead is steady and weak in the US, where the price 13 cents a lb. is under pressure owing to the persistent flow of metal across the Atlantic. Zinc is firmish in London, although activity is patchy. The Board of Trade has decided that in view of the state of the zinc market no further zinc will be offered for sale for the time being. An announcement will be made when it is decided to resume sales. In America, the market position is still unsatisfactory and with the possibility looming of a strike in the automobile industry the outlook is not bright. The price is still called 10 cents per lb.

Yorkshire Copper and ICI Merger

Yorkshire Imperial Metals, Limited, has been registered as a private company to carry into effect a merger of the undertaking of Yorkshire Copper Works, Limited, with the undertaking comprising the production, sale, and distribution of copper and copper-alloy tubes, ferrules, plates, and tube fittings, lead and lead-alloy sheet and pipe, and zinc chloride, carried on by the metals division of Imperial Chemical Industries, Limited.

The new company's nominal capital is £100 in £1 shares and will be jointly and equally owned by Yorkshire Copper and ICI. The proposals were submitted to a meeting of Yorkshire Copper shareholders when it was proposed that the name should be changed to Yorkshire Copper Works (Holdings), Limited.

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Current Prices of Iron, Steel, and Non-ferrous Metals

(Delivered unless otherwise stated)

February 5, 1958

PIG-IRON

Foundry Iron.—No. 3 IRON, CLASS 2:—Middlesbrough, £21 6s. 0d.; Birmingham, £20 18s. 3d.

Low-phosphorus Iron.—Over 0.10 to 0.75 per cent. P, £23 17s. 0d., delivered Birmingham. Staffordshire blast-furnace low-phosphorus foundry iron (0.10 to 0.50 per cent. P, up to 3 per cent. Si), d/d within 60 miles of Stafford, £24 1s. 3d.

Scotch Iron.—No. 3 foundry, £25 3s. 6d., d/d Grangemouth.

Cylinder and Refined Irons.—North Zone, £25 19s. 0d.; South Zone, £26 1s. 6d.

Refined Malleable.—P, 0.10 per cent. max.—North Zone, £27 6s. 6d.; South Zone, £27 9s. 0d.

Hematite.—Si up to 2 per cent., S. & P. over 0.03 to 0.05 per cent.:—N.-E. of England (local iron), £25 6s. 6d.; Scotland (Scotch iron), Zone S.1, £25 13s. 0d.; Sheffield, £26 15s. 0d.; Birmingham, £27 4s. 0d.; Wales (Welsh iron), £25 6s. 6d.

Basic Pig-iron.—£20 3s. 0d., delivered Staffs, Derbyshire, Notts, Lincs, Rutland, Northants, and Leics.

FERRO-ALLOYS

(Per ton unless otherwise stated, delivered)

Ferro-silicon (6-ton lots and over).—45 per cent. Si, £48 10s. 0d. to £50 15s. 0d., scale 17s. 0d. to 17s. 6d. per unit; 75 per cent. Si, £68 10s. 0d. to £76 7s. 6d., scale 17s. 0d. to 17s. 6d. per unit.

Ferro-vanadium.—50/60 per cent., 26s. 6d. per lb. of V.

Ferro-molybdenum.—65/70 per cent., carbon-free, 12s. 6d. per lb. of Mo.

Ferro-titanium.—20/25 per cent., 2-3 per cent. Cu, £250 0s. 0d.; 38/40 per cent., commercially carbon-free, £299 0s. 0d.

Ferro-tungsten.—80/85 per cent., 8s. 5d. per lb. of W.

Tungsten Metal Powder.—98/99 per cent., 11s. 5d. per lb. of W.

Ferro-chrome (6-ton lots and over).—4/6 per cent. C, £93 0s. 0d. to £96 10s. 0d., basis 60 per cent. Cr, scale 32s. 0d. per unit; over 6 per cent. C, £91 0s. 0d., basis 60 per cent. Cr, scale 31s. 0d. to 32s. 0d. per unit; 2 per cent. C,* 2s. 2d. per lb. Cr; 1 per cent. C,* 2s. 2½d. per lb. Cr; 0.15 per cent. C,* 2s. 3½d. per lb. Cr; 0.10 per cent. C,* 2s. 3¾d. per lb. Cr; 0.06 per cent. C,* 2s. 4d. per lb. Cr.

Metallic Chromium.—98/99 per cent., 7s. 3d. to 7s. 10½d. per lb.

Metallic Manganese.—90/92 per cent., carbon-free, £290 0s. 0d.; 96/98 per cent., £310 0s. 0d.

Ferro-columbium.—65/75 per cent., Nb + Ta, 20s. 9d. to 21s. 3d. per lb., Nb + Ta.

Ferro-manganese (home).—78 per cent., £87 19s. 3d.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms, and Slabs.—BASIC: Soft, u.t.s. £33 1s. 6d.; tested, 0.08 to 0.33 per cent. C, £34 1s. 6d.; hard (0.41 to 0.60 per cent. C), £35 3s. 0d.; silico-manganese, £44 2s. 6d.; free-cutting, £37 5s. 6d. SIEMENS MARTIN ACID: Up to 0.25 per cent. C, £41 7s. 0d.; silico-manganese, £44 10s. 0d.

Billets, Blooms, and Slabs for Forging and Stamping.—Basic, soft, up to 0.33 per cent. C, £38 16s. 0d.; basic, hard, over 0.41 up to 0.60 per cent. C, £39 18s. 6d.; acid, up to 0.25 per cent. C, £43 10s. 0d.

FINISHED STEEL

Heavy Plates and Sections.—Ship plates (N.-E. Coast), £42 12s. 0d.; boiler plates (N.-E. Coast), £45 2s. 0d.; floor plates (N.-E. Coast), £44 1s. 0d.; angles (N.-E. Coast), £40 6s. 6d.; joists (N.-E. Coast), £40 2s. 6d.

Small Bars, Sheets, etc.—Rounds and squares, under 3 in., and flats, 5 in. wide and under, untested soft basic, 50 tons and over, £40 8s. 0d. (under 10 tons to 4 tons, £41 5s. 6d.; under 4 tons to 2 tons, £41 10s. 6d.); hoop and strip, coils, £40 10s. 0d.; uncoated strip mill coils, hot rolled, under 3mm. to 12g., £45 16s. 0d.; black sheets (hand mill), 24g., £59 4s. 6d.; galvanized corrugated sheets, 24g., £67 6s. 0d.

Alloy Steel Bars.—1 in. dia. and up: Nickel, £69 9s. 6d.; nickel-chrome, £100 12s. 6d.; nickel-chrome-molybdenum, £112 16s. 6d.

NON-FERROUS METALS

Copper.—Cash, £167 5s. 0d. to £167 10s. 0d.; three months, £168 5s. 0d. to £168 10s. 0d.; settlement, £167 10s. 0d.

Copper Tubes, etc.—Solid-drawn tubes, 1s. 7⅝d. per lb. rods, 192s. 0d. per cwt. basis; 20 s.w.g., 225s. 3d. per cwt.

Tin.—Cash, £730 0s. 0d. to £730 10s. 0d.; three months, £729 0s. 0d. to £730 0s. 0d.; settlement, £730 10s. 0d.

Lead (Refined Pig).—First half February, £73 10s. 0d. to £73 15s. 0d.; first half May, £73 10s. 0d. to £73 15s. 0d.

Zinc.—First half February, £65 0s. 0d. to £65 10s. 0d.; first half May, £64 0s. 0d. to £64 5s. 0d.

Zinc Sheets, etc.—Sheets, 15g. and thicker, all English destinations, £98 15s. 0d.; rolled zinc (boiler plates), all English destinations, £96 10s. 0d.; zinc oxide (Red Seal), d/d buyers' premises, £95 0s. 0d.

Brass Tubes, etc.—Solid-drawn tubes, 1s. 4½d. per lb.; sheets to 10 w.g., 149s. 0d. per cwt.; wire, 2s. 2⅝d.; rolled metal, 149s. 0d. per cwt.

Brass (Brazing).—BS1400, B3 (65/35), £128; B6 (85/15), —; BS249, —.

Brass (High Tensile).—BS1400, HTB1 (30 tons), £173; HTB2 (38 tons), —; HTB3 (48 tons), £192.

Gunmetal.—BS1400, LG2 (85/5/5/5), £157; LG3 (86/7/5/2), £167; G1 (88/10/2/½), £219; (88/10/2/1), £210.

Phosphor Bronze.—BS1400, PB1 (AID released), £235 per ton.

Phosphor Bronze Strip, etc.—Strip, 218s. 6d. per cwt.; wire, 3s. 5d. per lb.; rods, 2s. 8¾d.; tubes, 2s. 8¾d.; chill cast bars: solids 2s. 10½d.; cored 2s. 11½d. (CHARLES CLIFFORD, LIMITED.)

Nickel Silver, etc.—Rolled metal, 3 in. to 9 in. wide × 0.056, 3s. 3¾d. per lb.; round wire, 10g. in coils (10 per cent.), 3s. 8½d.; special quality turning rod, 10 per cent., ½ in. dia., in straight lengths, 3s. 7½d. All prices are net.

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Pig-iron and Steel Production

Statistical Summary of November Returns

The following particulars of pig-iron and steel produced in Great Britain are from statistics issued by the British Iron and Steel Federation. Table I summarizes activities during recent months. Table II gives production of steel ingots and castings in November and Table III, weekly average production of finished steel. Table IV gives the production of pig-iron and ferro-alloys in November, and furnaces in blast. (All figures are weekly averages in thousands of tons.)

TABLE I.—*Iron and Steel Price Index and General Summary of Pig-iron and Steel Production.*

Period.	B.o.T. Price Index, 1938 = 100.			Iron-ore output.	Imptd. ore used.	Coke to blast-furnaces.	Pig-iron, ferro-alloys prod.	Scrap used in steel prod.	Steel (incl. alloy).			
	I. & S.	Coal.	Basic materials excl. fuel [1]						Imports. [2]	Prod. ingots, castings.	Delivrs. finished steel.	Stocks. [3]
1955	276	399	529	311	244	246	240	213	29	381	305	1,247
1956	295	454	542	312	272	264	253	216	27	397	318	1,444
1957—July [4]	320	501	537	316	292	264	263	190	17	362	273	1,579
Aug. ..	341	502	535	299	313	267	272	190	13	373	270	1,673
Sept. ..	342	501	525	326	313	271	283	233	13	438	339	1,635
Oct. [4]	343	503	516	330	322	274	285	232	10	438	340	1,574
Nov. ..	342	513	508	317	319	273	282	229	16	429	—	1,485

TABLE II.—*Weekly Average Production of Steel Ingots and Castings in November*, 1957

District.	Open-hearth.		Bessemer.	Electric.	All other.	Total.		Total ingots and castings.
	Acid.	Basic.				Ingots.	Castings.	
Derby, Leics., Notts., Northants and Essex ..	—	4.5	11.5 (basic)	2.6	0.1	17.1	1.6	18.7
Lancs. (excl. N.W. Coast), Denbigh, Flints., and Cheshire	1.6	37.2	—	2.6	0.5	40.3	1.6	41.9
Yorkshire (excl. N.E. Coast and Sheffield) ..								
Lincolnshire	—	44.9	—	—	0.1	44.8	0.2	45.0
North-East Coast	0.5	82.6	—	1.6	0.5	82.9	2.3	85.2
Scotland	2.7	47.9	—	2.8	0.2	51.2	2.4	53.6
Staffs., Shrops., Worcs. and Warwick	—	20.1	—	1.4	0.8	20.3	2.0	22.3
S. Wales and Monmouthshire	3.9	84.8	7.4 (basic)	1.2	0.2	96.8	0.7	97.5
Sheffield (incl. small quantity in Manchester) ..	10.0	34.4	—	12.6	0.5	55.3	2.2	57.5
North-West Coast	—	1.9	4.9 (acid)	0.6	0.1	7.4	0.1	7.5
Total	18.7	358.3	23.8	25.4	3.0	416.1	13.1	429.2
October, 1957 [4]	20.0	364.2	25.3	25.3	3.0	424.7	13.1	437.8
November, 1956	19.2	351.5	27.0	25.6	3.1	413.6	12.8	426.4

TABLE III.—*Production of New Non-alloy and Alloy Finished Steel.*

Product	1955.	1956.	1956.	1957.	
			Oct.*	Sept.	Oct.*
Non-alloy steel:					
Ingots, blooms, billets and slabs [5]	4.9	4.7	5.1	5.1	5.2
Heavy rails ..	9.4	9.7	10.1	11.5	11.5
Sleepers, etc. ..	2.0	1.8	1.8	2.2	2.1
Plates, 3 mm. and over	46.1	50.2	54.7	55.6	55.8
Other heavy prod. ..	47.8	50.3	53.6	54.7	57.1
Ferro-con. bars, etc.	7.0	7.8	8.8	10.2	8.9
Wire rods	22.2	22.9	23.6	25.5	26.3
Arches, etc. ..	9.6	10.1	11.2	11.5	11.2
Other light sections	36.8	41.4	45.3	39.0	40.0
Brigh steel bars ..	7.8	8.0	8.1	7.4	7.1
Hot-rolled strip ..	24.1	24.5	26.1	24.5	24.6
Cold-rolled strip ..	8.1	7.5	6.7	7.8	7.8
Sheets, incl. coated:					
(i) Hot rolled ..	16.6	15.0	15.2	13.7	13.4
(ii) Cold reduced	26.1	24.8	26.7	29.6	32.2
Tin and terneplate	15.6	15.9	17.9	21.8	18.3
Blackplate.. ..	1.4	1.3	1.3	1.2	1.1
Steel tubes, pipes..	22.9	26.2	26.2	28.7	26.0
Tube, pipe fittings	0.4	0.5	0.5	0.5	0.4
Tyres, wheels, axles	4.8	4.6	4.7	5.1	6.2
Forgings (excl. drop forgings) ..	2.5	3.0	3.0	3.2	3.1
Steel castings ..	4.2	4.5	5.0	5.0	5.2
Tool and magnet steel	0.3	0.3	0.3	0.3	0.3
Total	320.6	335.0	355.9	364.1	363.8
Alloy steel	15.8	17.3	17.5	20.3	18.9
Total deliveries from U.K. prod.[6] ..	336.4	352.3	373.4	384.4	382.7
Add: Imported finished steel ..	18.9	19.5	12.7	9.3	10.7
	355.3	371.8	386.1	393.7	393.4
Deduct: Intra-industry conversion[7] ..	50.9	55.2	57.8	55.8	54.1
Total new material ..	304.4	316.6	328.3	337.9	339.3

TABLE IV.—*Production of Pig-iron and Ferro-alloys during November*, 1957

District.	Furnaces in blast.	Hematite.	Basic.	Foundry.	Forge.	Ferro-alloys.	Total.
Derby, Leics., Notts., Northants and Essex	22	—	19.6	23.0	0.7	—	43.3
Lancs. (excl. N.W. Coast), Denbigh, Flints. and Cheshire ..	7	—	21.2	—	—	1.6	22.8
Yorkshire (excl. N.E. Coast and Sheffield) ..							
Lincolnshire ..	10	—	42.2	—	—	—	42.2
North-East Coast	21	4.6	57.2	—	—	1.3	63.1
Scotland	10	0.9	22.8	1.3	—	—	25.0
Staffs., Shrops., Worcs. and Warwick ..	6	—	8.3	1.7	—	—	10.0
S. Wales and Monmouthshire	11	4.8	45.2	—	—	—	50.0
Sheffield	2	—	3.7	—	—	—	3.7
North-West Coast	9	19.9	—	0.2	—	1.3	21.4
Total ..	98	30.2	220.2	26.2	0.7	4.2	281.5
October, 1957 [4] ..	96	32.5	225.9	22.4	0.6	4.1	285.5
November, 1956	100	30.8	200.4	28.5	0.3	2.7	262.7

[1] Used in non-food-manufacturing industry.
[2] Weekly average of calendar month.
[3] Stocks, mainly ingots and semi-finished, at the end of the years and months shown.
[4] Five weeks, all tables.
[5] Other than for conversion into any other form of finished steel listed.
[6] Includes finished steel produced in the U.K. from imported ingots and semi-finished steel.
Material for conversion into other products also listed in this table.